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THE FUNDAMENTAL PRINCIPLE OF HYGIENE

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If we take a kernel of grain from the tomb of an Egyptian mummy that has been preserved for 3000 years and a kernel of grain from last year's harvest, the two apparently are exactly alike; but if we stimulate them by electricity, the latter responds causing a blazing up of the current, the other does not. If we stimulate them by crushing, the latter responds by an increased elimination of CO_2 indicating increased metabolism, the other does not respond. If we put the two into the ground under suitable conditions, the latter responds by growth, the other does not (27).

Thus the difference between the living organism and dead matter is the ability of the former to respond to stimulation; and these three tests determine living tissue: first, the possibility of growth; second, response to electrical stimulation; third, chemical response to stimulation. These forms of response are based on the fundamental characteristic of living matter, irritability; each of these represents probably a change in metabolism. This ability to respond to stimulation is the test of life everywhere, and an optimum stimulation and response represent the condition of health.

It is not the place here to discuss the nature of the processes involved in stimulation. Those interested can consult the book on "Irritability" by Verworn (28) and the recent article on "Stimulation" by Professor Lillie in the Popular Science Monthly (17). Loeb is critical of the word stimulation, saying it is apt to be used to hide our ignorance of causes. While this may be true as regards deeper biological causes, and it

may be well in some cases to avoid the use of the word as Loeb does, in psychology and hygiene, on the other hand, a generic word of this kind is indispensable.

To maintain a condition of healthful function, it is necessary to keep stimulation and response within certain limits; overstimulation, understimulation, overreaction, and lack of reaction, are alike injurious to health. Hence the fundamental principle of hygiene may be stated tentatively in terms of stimulation and response somewhat as follows:

To maintain the human organism in a condition of health it is necessary that each organ receive an optimum stimulation and have opportunity for normal response.

Any significant change in environment is the stimulus for a reaction of the organism involving a change in metabolism. Thus all the problems of hygiene are probably fundamentally problems of metabolism. This way of looking at the activity of living tissue does not of course take us anywhere in particular. It does not tell us what metabolism is, nor does it solve our concrete problems ordinarily; but it places the emphasis upon function, it puts hygiene in harmony with other sciences, and it does give the right attitude. This attitude, general though it is, is an important one. It makes us look in the right direction for the solution of our problems; and one is much more likely to see the sunrise if looking toward the east than if looking toward the west. It is not a mere tag for labeling different forms of behavior, and the like; but it is really a significant statement of the fundamental condition of life and health in a general form, and it gives the proper point of view for understanding many problems that otherwise are likely to be obscure.

First of all this point of view puts hygiene in line with the other sciences with which it is closely connected. Hygiene bases its doctrines on the teachings of modern chemistry, biology, physiology, and psychology. Unfortunately the results of these sciences often remain unused for many years before their significance for hygiene is recognized. That the contribution of these sciences may be utilized as quickly as possible it is especially desirable that the point of view and methods of hygiene should be in harmony with those used in these subjects.

Nothing perhaps would express better the general point of view of the recent investigations in these related sciences significant for hygiene than this of stimulation and response. It is illustrated notably in chemistry, in the modern studies of katalysis and the like; in biology, in the phenomena of animal behavior; in physiology, in the notable experimental discoveries in regard to respiration and the functioning of the other

vital organs; in psychology, not only in genetic and comparative psychology, but to a large extent in general psychology, obviously in the psychophysical phenomena; and even in philosophy, one school at least, the modern pragmatists, defines the theory of knowledge in terms of reaction to stimulation. Thus Professor Dewey's position, as interpreted by Miss Goodsell (II), is: with an organism whose continued existence depends upon acquaintance with things and successful reaction to them, we may naturally raise the question, "Is it not probable that man first acquired knowledge in the struggle to act efficaciously in response to concrete stimuli?" In like manner the best general point of view for modern hygiene is that which looks upon the normal healthful activity of the organism as best expressed in terms of stimulus and reaction.

Stimulation

A few years ago we looked upon the whole matter of stimulation as a relatively simple thing; now we see that it is vastly complex. Roughly there are three kinds of stimuli; first, the blood stimuli, which may be illustrated by the hydrogen ion concentration of the blood, which serves as a stimulus to respiration; second, the socalled hormones from the glands with internal secretion, which are also carried by the blood, but are specific stimuli regulating growth and the distribution of energy in the body; and third, the nervous stimuli, which again represent a vastly more complex mechanism than used to be supposed.

1. *The Blood Stimuli.*—The process of respiration furnishes a good example of the significance of the blood stimuli. The activity of the breathing center located in the medulla is regulated especially by the stimulating substances carried to it by the blood. The mechanism is complex, in part as follows:

We never expel all the air from the lungs. What is left is called the alveolar air. Normal respiration is largely conditioned by the residual CO_2 in this air. Under ordinary conditions it is estimated that the air in the pulmonary alveoli contains 500 parts of CO_2 per 10,000 of air. If this gas is removed by modern methods or by forced breathing, the result is that the patient ceases to breathe. In other words, it is necessary that there should be about 5-6 per cent of CO_2 in the lungs, as a stimulus that is transferred to the blood and carried to the breathing center. Thus respiration, as shown by modern studies, is a case of response to stimulation. The CO_2 in the lungs is the stimulus and the respiration is the response. If the alvelolar CO_2 is too great, that is, the stimulus too strong, then there is increased respiration. If, on the

other hand, the alveolar CO_2 is too small, that is, the stimulus too weak, the respiration is reduced; and with extreme ventilation of the lungs and extreme reduction of the CO_2 respiration ceases altogether.

Haldane's studies (12) have shown that cessation of respiration, or apnea, is "simply due to excessive removal of carbon dioxide from the alveolar air." That is, the proper stimulus is lacking and the reaction does not occur. Under ordinary circumstances the amount of residual CO_2 is maintained remarkably constant. If one breathes deeply, the respiration is slow. If one breathes rapidly, the respiration is shallow.

As already suggested, the reserve or alveolar CO_2 determines the amount of CO_2 in the blood. This in turn determines the action of the respiratory center in the medulla. This center reacts with great delicacy to slight changes in the blood. To put the whole matter perhaps more accurately, we may say that the alveolar CO_2 determines the hydrogen ion concentration of the blood, and this is the stimulus to the respiratory center. The response is reaction of the center in determining the activity of respiration. (12a, p. 29.)

That the alveolar CO_2 is really the original stimulus has been proved by experiments by Fredericq which have shown that apnea is produced when the respiratory center of one animal is supplied with blood from another animal whose lungs have been excessively ventilated, thus reducing the amount of alveolar CO_2 and causing an over aeration of the arterial blood.

The condition of the blood which causes increased respiration on the one hand, or apnea on the other, is excessive acidity or too great alkalinity of the blood; and modern study has shown that the alkalinity or acidity of a liquid depends upon its hydrogen ion concentration. As already noted the alveolar CO_2 percentage under ordinary resting conditions is practically constant and this shows that the hydrogen ion concentration of the blood is regulated with the greatest delicacy, and it is regulated apart from breathing. Breathing simply regulates the rapid disturbances in the hydrogen ion concentration caused by variations in the production of CO_2. Other disturbances are regulated otherwise than by breathing. The kidneys and liver play a part in this regulation.

Thus modern physiology shows that respiration is interconnected with a number of other normal activities. As Haldane expresses it:

> "Now let us look back for a moment, and see where we now stand. The experimental study of the physiology of breathing has led us to the discovery of four normals, the maintenance of which

furnishes the interpretation of a mass of what would otherwise be isolated and unintelligible observations. We have first of all the normal alveolar CO_2 pressure. This turns out to be directly subordinate to the normal regulation of the hydrogen ion concentration of the blood, the normal reaction of the respiratory center to hydrogen ion concentration, and the normal regulation of the capacity of the blood for carrying CO_2. With the discovery of each of these normals we have obtained deeper and deeper insight into the physiology of breathing. We have done this, not by merely seeking for causes in the physical sense, but by seeking for interconnected normals and their organization with reference to one another and to other organic normals." (12a, p. 30.)

The marvelous manner in which the conditions of health are determined by keeping the proper balance between the stimulation of the environment and the reaction of the organism is thus illustrated by the results of modern physiology that show the way the vital functions like respiration depend on a most delicate balance between the internal forces of the organism. The extreme complexity of this organic balance is suggested in the following passage from Haldane:

"An obvious possible interpretation is that each of the various organs concerned in the balancing process has such a physical and chemical structure that it reacts to a given small deviation in the internal environment so as to prevent further deviation in this direction. As the combined result of the reactions of all the organs the internal environment as a whole remains constant. It is evident, for instance, that the respiratory centre reacts to very small differences in the hydrogen ion concentration in the blood, in such a way as to prevent larger differences from occurring. The temperature-regulating centre reacts to small differences in the blood-temperature. The kidneys react in a similar way to very small differences in the concentrations of water, urea, and numerous other inorganic or organic substances. The organs, such as the liver, or fat-containing tissues, in which material is stored, appear to behave similarly; and we have now every reason to believe that we should find the same regulating activity in every organ or part of the body if our methods of investigation were sufficiently delicate, and we knew the small differences to be detected. In every direction the progress of physiology and pathology is revealing the astounding delicacy and complication of the regulating processes."

Again we may sum the matter up in regard to the normal conditions of CO_2 as the stimulus to respiration in the words of Haldane. "Thus we find that the normal concentration of carbon dioxide in the alveolar air is connected with or subordinate to the normal composition of the blood, the normal activity of the respiratory center, heart, kidneys, and other organs, the normal composition and amount of the food and the normal concentration of oxygen in the air."

Our illustration from the physiology of respiration is instructive, for it shows how our point of view protects us from error. The older physiology of respiration looked upon this

vital process as a relatively simple matter, the rythmic processes of expiration and inspiration being regulated by the respiratory center, and this the whole story. From our present point of view of stimulation and response, however, we inquire what is the stimulus to this physiological reaction in the process of respiration and we find the answer in the results of modern investigation which shows it to be a blood stimulus, namely, the alveolar CO_2 and the hydrogen ion concentration in the blood, and we find that this function of respiration instead of being a simple matter is a very complex affair.

Again our present point of view shows the need of CO_2. This socalled poison, which many widely used books today describe as a substance very injurious to the human organism, we find is the necessary stimulus for the vital process of respiration, that it is a constituent of the blood absolutely essential for life and health. It is so vital, as shown by the investigations of Henderson, that, as Haldane puts it, "An environment of CO_2 is apparently as essential as an environment of oxygen."

Such blood stimuli represent apparently the most ancient mode of interconnection and coordination of the different bodily organs. Another class of stimuli, although inadequately known and the subject of diverse opinion, are apparently carried by the blood, but in any case may well be treated as a special class.

2. *The Hormones.*—Another primitive method of communication between different organs of the body is to send a special messenger, or hormone (from the Greek ὁμάω, to send a messenger). The hormones are secretions from the socalled endocrine glands, and act as vitally important stimuli regulating growth and development. Only in recent years has the tremendous importance of the stimulation by the glands with internal secretion been recognized. These glands when functioning in normal mutual relations not only stimulate and regulate normal growth and development, but they furnish the proper stimuli for the various forms of metabolism (2).

Hence all the phenomena of growth and development may be looked upon as phenomena of stimulation and response. If growth is to be normal, there must be the right relation between the stimuli to growth and the opportunity for development. This may be illustrated by the simplest form of growth, that which occurs by putting a seed into the ground. The definite conditions of the soil, temperature, humidity, and the like, are the stimuli, the growth of the seed is the normal reaction to these stimuli. The same is true of growth and development everwhere; but growth in the human body is

regulated by certain special stimuli, namely, these secretions of the endocrine glands. In part we know their functions. Roughly we may say: The thyroid stimulates growth. The pituitary inhibits growth. The pineal gland prevents premature development. The parathyroids, thyroid, and adrenals largely regulate metabolism; the mutual relations of these glands condition normal development.

All the growth activities of the organism, from the growth of the individual neurone to that of the skeletal structure of the body, may be represented from this point of view. To illustrate this, we may take the most extreme case, namely, that of the growth, development, and normal condition of the bones of the body. The bony structure we consider permanent and stable. On the contrary, the bone like all the other tissues of the body is subject to continuous processes of metabolism. Recent investigations have shown that the breaking down of old bone, the building up of new bony tissue, anabolism and katabolism, are continually going on, and that the bone by no means represents dead structure, but on the contrary it is the seat of active metabolic processes. The building up of the bony tissue and the health of the structure depend, as in case of all other structures, upon optimum stimulation and reponse, the stimulus to the building up processes being furnished by the glands with internal secretion.

During the early years of life, under the influence of the stimulation from the endocrine glands, the organism responds by the reaction of growth and development. This is the one thing for which the child's organism is fitted. For hygiene it is the fundamentally important thing. Everything else can wait, but this is essential.

When growth ceases, much the same stimuli seem to continue active, but the form of reaction changes from growth to function; and, just as growth is an essential condition of health in the early years, so in maturity, function is an essential condition of health. Apparently the transition from the one form of reaction to the other is a critical matter. It is desirable that by gradual training to habits of healthful activity this transition be effected in part before growth is completed.

The stimulation and regulation of growth by the endocrine glands, we may suppose, is effected by the regulation of metabolism. More concretely, as regards metabolism, the specially important function of the thyroid seems to be iodin metabolism; that of the parathyroids, perhaps calcium metabolism; and that of the adrenals, carbohydrate metabolism. These glands have also mutual relations of stimulation and perhaps of inhibition. Their further action in stimulating

function is notably illustrated by the adrenal glands. The effects of stimulation by the secretion from these glands, adrenalin, are many, as shown by recent experiments, among them the following: It maintains the temperature of the body (Doeblin and Fleischman); it increases the number of red blood corpuscles (experiments at Baltimore); in small doses (Hartman and McPhedran) it causes constriction of the vessels of the intestine, the kidney, and generally of the spleen. Increase of the dose causes marked dilatation of the intestine. Especially interesting is the emergency function of the adrenals correlated with emotion and excitement. If we can trust the results found by Cannon (6), the physiological concomitants of emotion are in part as follows:

An increased secretion of adrenalin into the blood serves as an emergency call. All the forces are mobilized for action. There is an increase in the pulse rate, in the blood pressure, in the blood supply to the muscles, an increase in the body temperature, an increased secretion of sugar from the liver, an increase even in the clotting power of the blood, and probably usually a checking of digestion.

The character and constituents of the hormones we do not know. Probably they are of relatively simple chemical constitution and easily destroyed. The things that may be inferred in regard to this class of stimuli have been summed up as follows by Starling (26):

"(1) In the first place, they must not be antigens, i.e., their injection into the blood stream must not involve the production of an anti-body. If this were the case, the hormone, on entering the blood-stream, would meet its anti-body and would be unable to exert any effect on the appropriate reacting organ. Practically all the complex colloid bodies allied to the proteins, e. g., ferments, egg albumin, peptone, sera of different animals, when injected into the blood stream, cause the production of the corresponding anti-body. The hormones must be simpler in character than such substances and probably have a precise and comparatively simple chemical or molecular constitution."

"(2) Since they must be carried by the blood-stream to the reacting organ they must in most cases be susceptible to easy passage through the walls of the blood-vessels if they are to excite a reaction within a fairly short space of time. This consideration would also tend to keep their molecular weight comparatively low."

"(3) As a rule the chemical messenger must excite a state of activity in response to a change in some other part of the body. When the primary change passes away, the action of the hormone should also disappear. On this account

it is necessary that the hormone should either be susceptible of easy destruction, by oxidation or otherwise, in the fluids of the body, or be readily excreted, so that its action may not be continued indefinitely."

3. *The Nerve Stimuli.*—Stimuli are carried to the central nervous system either by the sensory nerves or by the blood. It is customary to divide them according to their effect into exciting and depressing stimuli. Exciting stimuli bring about an acceleration, an increase in the intensity of the metabolic processes; depressing stimuli retard and lessen the vital processes or arrest them altogether. We are concerned especially with the stimuli carried by the nerves.

Fröhlich (10) points out that if stimuli are excluded as much as posible from a portion of the nervous system, a changed appearance of the nerve cells results. If the sensory nerves of one area of the central nervous system are severed, or the motor nerves are severed, and thus the innervation of the ganglion cells belonging to them is limited; then after some days, characteristic changes of the nerve cells appear. The Nissl granules disintegrate, the cell nucleus is displaced towards the periphery, the cells become distended, and, finally, there follows a decrease in their mass, a functional atrophy resulting from inactivity. If, on the other hand, the nerve substance is frequently stimulated, we see an increase in the size of the nerve cells and their processes, an hypertrophy as a result of function. This has been shown by the classic experiments of Berger, who studied the visual centers of dogs blind from birth in comparison with those of normal dogs, and found in the one case that the nerve cells were small and embryonic in character, while in the other they were mature and of normal size. Such experiments show that stimulation is an essential condition of normal development of the nerve centers. Also in the study of the genesis of the nervous system, as we have seen, the striking fact appears that it is developed from the outside layer, from the epiblast, not from the mesoblast, and then folded in to make the tube which constitutes its initial form. Thus, as pointed out by Hodge, apparently it is only by contact with an external world of stimuli that the nervous system has its origin.(5)

Stimulation as modern studies have also shown, has played a great part in the phylogenetic development of the nervous system as well as in individual development. While in the case of the individual development of the human nervous system the number of neurones seems to be complete before the end of the second year of life; and in further growth the cells merely increase in size and in the development of their

processes, in the phylogenetic development under the influence of stimuli the number of the nerve cells has greatly increased. For example, the cerebellum has the function of maintaining the body equilibrium. In case of the animals that move little, it is only slightly developed; but, on the other hand, in case of birds, it shows an extraordinarily great development. With the development of the brain cortex the same is true. The cortex has its greatest development in the case of man.

Stimulation conditions also the development of the nerve processes. The nerve cells of higher animals show a far greater development of their cell processes than those of lower animals. The rôle of stimulation in the development of the nervous system has been noted in detail in an article by the writer, published in the American Journal of Psychology (5), but we may recall here that the great Spanish neurologist, Ramon y Cajal, has found that the dendrites of the nerve cells, although spreading out almost equally at first, develop especially in the direction from which they get the majority of stimuli and atrophy along the lines from which they receive very few stimuli or none at all. These observations were based chiefly on ontogenetic studies. More recently Kappers (5), the Dutch neurologist has found the same phenomena phylogenetically.

Many concrete examples of the effect of stimulation upon development are given by Kappers. In several papers he has called attention to the fact that the motor nuclei of the oblongata occupy different positions in the different classes of vertebrates, and their different position is apparently caused by the different tracts from which the greatest stimulation comes to these nuclei. The motor nucleus of the tongue, for example, approaches the sensory centers of taste in those animals where taste is localized chiefly in the tongue.

Bok (3) in his study of chicken embryos found that if the morphological relations of the four-day old egg are given, the theory of the genesis of fibrillae by stimulation is sufficient for the explanation of the whole system of fibrillae of this organism, and that stimulation is the key to the whole development of nervous structure. Thus from the genetic point of view function precedes structure, rather than structure, function.

It is not strange that a condition necessary for the development of the nervous system both in the individual and in the phylum should also be necessary for the functioning of the nervous system. If stimulation is decreased, then the intensity of the metabolic processes is decreased and function is retarded; and if stimulation is excluded altogether, function ceases.

All our physiological reactions are adjustments to stimuli, or to changes in our internal condition or in our environment; and it is the function of the nervous system to regulate these adjustments. This is well illustrated in the automatic regulation of the bodily temperature. With most varying conditions of external temperature, as pointed out by Sherrington, this is kept remarkably constant.

In case of the nerves a stimulus is not always followed by a reaction. To take some of the common examples, if dust blows into one's nostrils, at first there is no reaction. It is only after an accumulation of dust has occurred that we sneeze. If a fly lights on one's forehead, the tickling at first produces no result, but after a short time one raises his hand to brush the insect away; so with coughing and many other reflex acts. The reason no reaction occurs at first but does afterwards, is due to the fact that the first stimulation is not sufficient with the degree of irritability present in the nerves involved to produce a response. It does, however, have an influence. A change takes place in the cell, which favors the appropriate reaction. When the next stimulus or a succeeding one occurs then the reaction does take place. This increment of change is called the summation of stimuli.

In other words, the application of the stimulus is followed by a measurable latent period in which the living substance is apparently at rest. The latent period has been especially studied in case of the muscle. It was discovered by Helmholtz more than 60 years ago and has been made the object of many investigations since that time. Tigerstedt has found experimentally that the duration of the latent period varies according to the intensity of the stimulus, the temperature, and the loading of the muscle or fatigue. As Verworn has said, "The facts concerning the whole latent period and its dependence on various factors would be incomprehensible if it were assumed that no alterations whatever take place during the latent period although the stimulus is already operative. In reality, the alterations following a stimulus occur with imperceptible rapidity in the form of molecular interchange. and the latent period is simply an expression of the fact that the primary alterations, being limited in nature, are not registered by our indicators." The nature of these alterations may be electrical; but we do not know.

Another characteristic of nerve function shown by the studies of stimulation and irritability is what is called interference of excitations. When different stimuli act upon the nerve substance we may have on the one hand summation of stimuli or on the other interference. Every cell of an organism is subject to manifold stimuli. Frequently two stimuli inter-

fere with each other and different results follow depending on the specific reaction of the cell and the quality, intensity and duration of the interfering stimuli. Verworn has given many illustrations of interference of excitations, and the phenomenon is of much practical significance.

The doctrine of the reflex arc, with its three phases—an incoming stimulus along an afferent nerve from some receptor organ, a central connecting process, and a response along an efferent nerve to some effector organ, a muscle or a gland—as the functional unit in the nervous system has been made explicit by Sherrington and is generally accepted.

As an illustration of the way this conception is used to explain the activity of the nervous system take the familiar activity in walking. Walking, as the explanation is usually given, is an automatic reflex function consisting simply of a series of reflex arcs. When the movement is once started by an act of the will or an external stimulus bringing about the reaction of contracting the muscles of the leg, the kinetic sensation of this movement is in turn the stimulus that sets free the nervous reaction for the next step, and that again for another, and so on. The activity is merely a series of reflexes. This is a simple and plausible explanation and may be taken as a typical example of explanation by the reflex arc as the functional unit. The recent studies by T. Graham Brown (4), however, cast doubt upon this and make it probable that the functional unit is the activity of what he terms a half center, or possibly a center composed of linked antagonistic half centers. In any case these experiments show that the old view of the reflex arc as representing everything accomplished by the nervous system is altogether too simple to represent adequately the facts.

Brown has studied progression in animals, experimenting with cats, and has used narcotics to paralyze the nerve centers. In this condition of "narcosis progression," as the act of locomotion under the influence of a narcotic is called, the progression takes place even after the peripheral afferent neurones have been paralyzed by the narcotic. Hence in this instance it is not possible that the stimulus from the afferent neurones is the cause of the step reflex, and apparently some other stimulus like the blood stimulus must be the cause. Brown says:

"It places the efferent neurone—or rather the linked pair of antogonistic efferent neurones or 'half-centers'—in an independent position as the morphological substructure of the functional unit of the nervous system. Upon them and activating them may be supposed to play two kinds of stimuli. Of these the first and most primitive is that

which corresponds to the 'blood-stimulus' in respiration; and the second is the more recent stimulus conditioned by the afferent path of what we know as the spinal reflex. In the light of this view the primitive activity of the linked 'half-centers'—of the morphological unit—is supposed to be rhythmic; but the rhythm is not looked upon as conditioned in regard to its period by metabolic factors. It is rather regarded as conditioned by the periodic blocking and unblocking ('fatigue'), at a point (synapse?) in the path of 'mutual inhibition' of inhibitory impulses which may have a much faster rate of rhythm of their own, and one perhaps conditioned by such metabolic factors. And again, in the light of this view it will be observed that a mechanism for reciprocal innervation is assumed to exist between the efferent 'half-centers' and not in the (or is not necessarily assumed to be confined in the) afferent neurones."

Apparently we have to count with the fact that both kinds of stimuli, the blood stimuli and the nerve stimuli, may act upon the efferent neurones, and that the former as well as the latter may cause a reaction.

Thus our best conception of normal development of the nervous system seems to be that resulting from an optimum relation between stimulus and response. And this principle illustrated in the development of each individual neurone has specially noteworthy illustration for hygiene in the general development and functioning of the nervous system. Undue stimulation brings about a premature development, and this is likely to result later on in arrest of development. To adapt a figure used by Dr. Donaldson, the growing organism that might have developed into a tree bearing fruit develops prematurely and becomes merely a barren shrub. Hence all hygienists fear any unrelated and precocious developments.

On the other hand, lack of stimulation makes development of the nervous system imperfect and the opportunity for higher developments is liable to pass without proper functioning, and again arrest of development occurs. Thus lack of stimulus in a child's environment, lack of proper incentive and opportunity for the functioning of the different organs and faculties at the proper time may result in an arrest of development which simulates the arrest of feeble-mindedness caused by lack of normal stimulation from the glands with internal secretion, or other congenital defect.

DISEASE AS THE RESULT OF ABNORMAL STIMULATION

Stimulation in Cases of Shock.—If the fundamental principle of hygiene is that of optimum stimulation and response, then it would seem probable that in certain cases of disease

the natural remedy might be the application of a suitably stimulus. This has proved to be the fact. Evidence that this is so is furnished in certain cases of shock as studied in the present war.

Two kinds of shock should be definitely distinguished. On the one hand, the nervous shock that comes from the noise and excitement of battle, a kind of shock that disorganizes the functioning of the nervous system to such an extent that an individual is liable to all kinds of peculiar and bizarre reactions; and second, shock similar to that in surgical operations, the socalled surgical shock, which is characterized especially by low blood pressure, weak pulse, and a general condition of collapse.

As regards nervous shock, it would appear that if any thing would upset the normal balance between stimulation and response it would be the terrific noise and excitement of modern trench warfare. It is not strange that this often results in shock. It is more remarkable that a forced reaction may effect a cure. In some cases the application of a strong stimulus and the opportunity for response restores the balance. Dr. Porter (24) reports a case:

"A soldier, bent like a ragpicker searching in the dust of Montmartre, was grasped under each arm by a stout assistant surgeon. To the muscles opposing the contracted group, the chief surgeon then applied a strong electric current in such a way that the resultant contraction would inevitably cause the patient to straighten up. The instant this occurred, the assistants walked off with the astonished patient, now in the erect position. The malign spell was broken. The patient saw that he could stand erect, and the battle was won."

If electricity and a forced reaction, as in this method, which is called "torpedoing," will succeed, why not some other violent stimulus, striking the patient, or the like? Probably in some cases it might be helpful, but naturally one does not like to experiment. Porter, however, reports another case that furnishes some evidence.

"One day there came a soldier who refused to be torpedoed. The chief surgeon insisted. The patient struck out wildly. From words they came, alas, to blows! The surgeon was an educated man; he had defended a Thesis; he knew *la boxe;* he was versed in what Littré terms the *pugilat anglais.* And, since knowledge is power, he prevailed—without electricity. The result was a resounding scandal, and the complete cure of the patient. The affair came at length before the Academy. It was decided that a soldier should suffer the surgeon, as a patriotic duty" (24).

In many cases the trouble seems to be a paralysis of the

normal ability to respond to normal stimuli. This is illustrated in many cases where the individual loses his ability to speak and apparently to hear. In such cases one of the best methods of cure seems to be to give a strong stimulus while the patient is in a period of excitement. An electric shock, a loud noise, or even psychic stimuli, may effect a cure.

Even surgical shock, the other form of shock, when studied in the light of recent investigations, seems to be in part at least due to interference with normal stimulus and response.

Dr. Henderson of Yale has shown that anything which produces a decrease in the normal amount of CO_2 in the blood causes serious disturbance of the circulation, producing symptoms similar to those observed in the surgical condition known as shock. If this decrease in the CO_2 in the blood produces the symptoms of shock, we may naturally infer that it would be probable in cases of shock that the condition might be caused by a decrease in CO_2.

Dr. Henderson, in a series of articles in the American Journal of Physiology, has given experimental evidence for this, indicating also that "pain, ether-excitement, sorrow, fear, and other conditions inducing shock involve excessive respiration," which would cause great reduction of the CO_2 in the blood.

Crile, who has studied cases of shell shock, reports that traumatic and psychic disturbances both increase the hydrogen ion concentration in the blood. This means increased respiration. Now in the cases like those reported by Dr. Porter, with probably both the serious traumatic lesion and the psychic disturbance, not to mention the extreme muscular exercise which the individual had carried out probably during the battle, there was likely to be this condition of acidity of the blood. Such a condition, as has been shown, causes a decrease in the amount of alveolar CO_2 and the amount of CO_2 in the blood. Naturally this might produce the symptoms of shock. If in any case this were the cause, the natural remedy would seem to be the administration of CO_2. Has CO_2 ever been tried as a remedy? As a matter of fact it has been used by Dr. Porter, and he has furnished us a case that seems to be distinctly in point, where the CO_2 was successfully used, although the case was complicated perhaps by the fact that it was a severe wound of the femur, and in such cases fat globules appear in the blood, which, in Dr. Porter's opinion, are the cause of severe disturbance of circulation and the phenomena of shock. Dr. Porter reports the case as follows:

"I found the surgeons just bandaging the stump of an amputated thigh. The man was pulseless. The head surgeon turned him over to me—they always do: the more desperate the case the more pleased they are to bestow him on some one

else. The man was taken to my tent and all the surgeons stood by to see what would happen. He was placed head down on a sloping table. Six large electric lights were arranged between him and his blanket. The mask was put over his head and the carbon dioxide turned on. In three minutes his pulse reappeared. Everyone was much pleased" (24).

Dr. Porter has developed a theory that in such cases of severe wound of the femur, the fat globules that pass into the blood cause the phenomena of shock. It hardly seems necessary to resort to such a theory; for with the decrease of CO_2 and the condition of the blood likely to be present the symptoms of shock might occur.

Whether or not Dr. Porter is right in his theory in regard to the fat globules plugging the capillaries, we have here a case of shock with congestion of the blood in the abdomen. As Porter puts it, "The man was bleeding to death in his own veins." We have also probably a decrease of CO_2 in the blood, as has been suggested. The natural remedy would be the use of CO_2. This was precisely what Dr. Porter resorted to.

The result was successful. The mechanics of the grosser physiological processes involved is well described by Porter:

"The air is drawn into the chest chiefly by the diaphragm, a large flat muscle which separates the chest from the abdomen. When the diaphragm descends in inspiration, the cavity of the chest is enlarged. If a squeezed rubber ball is allowed to expand under water, the surrounding fluid enters the ball. So, when the cavity of the chest is expanded, surrounding fluids enter the chest: the air is sucked in through the trachea, and blood is sucked in through the veins. The blood is sucked into the chest with considerable force. If the normal quiet contraction of the diaphragm so aids the entrance of blood into the chest, its powerful contraction will aid still more. Powerful and frequent contractions are within our command. We have but to increase the carbon dioxide in the inspired air to call forth deep and rapid respiration. The necessary amount of carbon dioxide is not injurious" (24).

This case is clearly a case instructive from our present point of view showing in concrete form the way that healthful respiration is dependent upon the normal stimulus of CO_2, and how serious disorder may be cured by restoring the normal stimulation. This is especially instructive also because it shows the way the normal activity of other vital physiological processes is dependent upon that of respiration. It is surprising to what a large extent defect and disease both physical and mental are due to a disturbance in stimulus or response. This is obviously so in the various disorders of metabolism and development.

Take rickets for example. What is the cause of this disorder so common in childhood? The answer most commonly given is to note some error in the diet of the children afflicted—lack of lime in the food on account of the substitution of artificial foods for the mother's milk, or the mother's food itself defective. Many difficulties are connected with this view; for rickets sometimes occurs in spite of a proper diet, and it does not always occur when there is serious defect in the diet.

The etiology of rickets is not as simple as this. The cause of many cases lies much deeper; but if we inquire in what other ways stimulation may have been defective we are naturally lead to think of the fundamental form of stimulation by the ductless glands, and this apparently is precisely where the cause frequently lies. There was in infancy lack of stimulation and a proper coördination between the different glands with internal secretion causing a lack of the proper calcium metabolism.

Again take the case of defective teeth. The fundamental cause of decaying teeth among civilized peoples in many cases is a lack of proper stimulation to metabolism in the early years of life. The cause frequently pointed out, that of the use of improper food and the lack of the coarser foods and a lack of proper use of the teeth in chewing, are all cases of lack of proper balance between stimulation and response; but the cause frequently lies deeper than all this, and the reason that primitive peoples have better teeth than civilized is by some writers believed to be the fact that primitive peoples live in a condition of out-door life and in an otherwise healthful environment, which does at least ensure normal activity of the glands with internal secretion.

While such disorders of development are largely due to lack of stimulation in the early years, the children afflicted are likely to be over-stimulated or over-repressed in later years. As pointed out by Pritchard this may occur as soon as the child begins to walk.

"When a child," he says, "hitherto suffering from rickets reaches the ambulatory stage, he introduces into his life a new outlet for energy, which is vastly greater in its dependence upon the courses of supply, than all other outlets put together. It is quite true that even the youngest baby is never quite motionless when he is awake, and is constantly calling some muscular activity into play, but the actual number of foot-pounds of work performed are enormously increased the moment the child 'finds the use of his legs.' The rickety child either walks himself into health, or dies on his back from some intercurrent disease such as bronchitis, diarrhoea, or

eclampsia. I have seen more than one child done to death by being put into splints to save its legs." (25, p. 59.)

Each organ of the body responds to certain stimulation in a definite manner; for the normal development of each, adequate stimulation is necessary; and defect of development occurs both with under stimulation and with over stimulation. This is illustrated not only in the growth of the body under the influence of the stimulation of the glands with internal secretion, but also in case of the individual organs.

All physiological stimuli, blows, mechanical lesions, poisons of various kinds, illustrate this. Any one of these in slight degree acts as a stimulus; in greater degree as a poison perhaps; in high degree as a deadly agent. Take, for example, almost any one of the common toxins. With sufficiently great dilution the poison acts merely as a physiological stimulus; with greater intensity it is a depressant and a poison, in still greater intensity it is a deadly poison; and the same effect is illustrated in the reaction of the human body to the toxic products of the various infectious diseases, and the like.

All the phenomena of bacteriology can be looked upon from this point of view. The whole doctrine of bacterial infection represents the conflict between invading organisms and the forces of the body. The toxins and antitoxins, the antigens and antibodies, the phenomena of anaphylaxis and anti-anaphylaxis, all represent the phenomena of stimulation and reaction, and are all very naturally approached from this point of view.

Not only are contagious diseases and the doctrine of bacteriology, which gives the modern explanation of them, best understood from the point of view of stimulation and response, but also many chronic diseases may naturally be viewed in that way; and from a hygienic point of view the practical question in many forms of chronic disease is what can be done to restore normal stimulation and response and what is the normal balance between stimulation and reaction that will insure the avoidance of such disease.

Nowhere perhaps is this view of normal stimulation and reaction as the condition of health of a physical organ better illustrated than in the modern doctrine of the hygiene of the heart. The old ideas seems to have been largely that the heart was endowed at birth with just so much potential energy and that it was capable of performing in a lifetime just so much work; hence any violent activity or any unnecessary strain upon the heart, especially in adult life, any unnecessary exercise, as in running or lifting or the like, especially in case of any cardiac weakness, by just so much decreased the store of the heart's energy and by so much would shorten an

individual's life. The modern view which looks upon the heart as an organ responding to stimulation like other organs shows that even in case of weakness or disease, the organ is improved by suitable exercise, and this has replaced the old fear of cardiac disease by a hopeful prognosis in most cases, provided proper hygiene of exercise involving normal stimulus and response and the right relation of the activity of the heart to the activity of the other organs are maintained.

Again, as Sir Lauder Brunton has shown, the heart muscle in its contraction massages itself, and so the function of the heart is a prime condition of further function; and often in case of disease, where the heart does not function properly, the giving of digitalis, which acts as a stimulus causing the heart muscle to contract more strongly, brings about by the very fact of this artificially induced exercise the ability to function, so that after a time the drug is not necessary as a stimulus.

The studies by Dr. MacKenzie of London (19) have gone much farther in the study of all cardiac disorders from the point of view of stimulus and response; and in a certain number of cases of heart irregularity, where there is skipping of a beat, or the like, when patients have been seeking for health for years, or in case of soldiers who have been rejected from the army, Dr. MacKenzie has often found that all that was necessary was to tell the patient to give up doctoring and go about his regular work.

These results of medical investigation which show that in many cases cardiac disorder results from lack of stimulation and lack of normal exercise of the heart are corroborated by the studies of Dr. R. Tait McKenzie (20) of Philadelphia, which indicate the advantage of physical exercise and the harmlessness of athletics in most cases.

Thus, the various cardiac disorders are best understood when studied from the point of view of stimulus and reponse, and the view of modern students like Dr. MacKenzie is that the activity of the heart is determined not by any innate stored up potential energy of which the individual has just so much and no more; nor by some inherent power residing in the heart muscle itself; but rather that the heart is a functioning mechanism like any other in the human body, which depends for its health upon proper exercise within the limits of normal stimulation and response, with the normal rhythm of work and rest. The heart continues its healthful function because the normal balance exists between stimulus and response. The failure of the diseased heart is due to disturbance of this normal balance. Dr. MacKenzie says:

"Now it cannot be too strongly insisted upon that that

process, which we recognize as natural in a healthy individual, is identical with the process occurring in an individual having some defect, whether the defect is due to disease of the heart itself or to other factors which embarrass the heart in its work. *The persistent forcing of a heart which is being denied a sufficient period of rest in which to recuperate itself is the real cause of every form of heart failure, no matter what the actual character of the disease may be.*" (19 p. 40.)

The various nervous and mental disorders are, as is well known, due to lack of stimulation or over stimulation or undue reaction to stimulation or repressed reaction, in any case to some disorder in this normal balance. As Pritchard illustrates this by the case of the child subject to rickets:

"The nervous system of the child who lives in the kind of environment that predisposes to rickets is exposed to faulty stimulation of both kinds, from want of stimulation in certain directions, and from over-stimulation in others. The most serious injuries that are inflicted are due to circulating poisons of endogenous manufacture. Faulty feeding, whether in respect of quantity or quality, will ultimately lead to disturbances of digestion or tissue metabolism, and in both cases to the production of poisonous bodies, which damage the delicate nerve-cells." (25, p. 63.)

The body of course may be subject also to various injurious stimuli. Against these, protective reactions have been developed. More concretely, Crile describes these as follows:

"As the tickle reflexes have been developed in response to attacks by insects and carnivora, so other material dangers, such as flying dust and débris, poisons, falling bodies, heat and cold, have added the reflexes of winking, coughing, sneezing, vomiting, fainting, shivering and sweating, which in like manner exemplify the adaptation of the organism as a whole or in part to specific menaces in the environment. Of all the ceptor mechanisms for protection the most wonderfully adequate are the mechanisms which guard the eye." (7, p. 77.)

Sneezing and coughing are striking examples of the protective adaptation of the organism, sneezing protecting the nose and throat from foreign bodies, coughing being a protective adaptation for the larynx and lungs.

Mental disorder and stimulation.—In the comprehensive definition of stimulus given by Verworn which includes any change, the stimuli that come from mental states are included just as much as physical stimuli; and as a matter of fact in our life as human beings these mental stimuli are quite as potent as physical stimuli.

Mental disorders are so largely due to defect in stimulation

or reaction that special attention may well be given to the various forms of mental stimuli.

Apart from heredity the cause of mental disorder is usually a poison of some kind from infection or indigestion, or some drug taken into the system, or lack of balance in stimulation from the glands with internal secretion, or the drive from social stimuli; or else, on the other hand, some injurious form of reaction or of repression. In a given case all of these may be combined.

Thus obviously mental disorders may be classified into two general classes; on the one hand, those that result from over stimulation, or under stimulation; and on the other hand those that result from lack of normal reaction, either arrest and repression of reaction, or over-reaction resulting from undue irritability.

Of course stimulation and reaction are usually bound up together in abnormal as well as in normal conditions. Lack of stimulation means lack of reaction; over stimulation means over-reaction; lack of reaction results in lack of stimulation; and over-reaction brings about abnormal irritability. As a rough division, however, for practical purposes this class is convenient.

Of the first class are the many cases of nervous and mental breakdown, especially of the manic-depressive type, and those more serious breakdowns which result from continued over-stimulation and the correlated arterio-sclerosis. Wherever there is constant stimulation from emotional excitement, either from over work or worry, or the like, where the adrenal glands are continually stimulating the thyroid, and the resulting increased metabolism and other physical effects are kept up continuously without rest or respite, as a result of this constant kinetic drive, as Crile calls it, nervous breakdown of serious character is likely to result.

Again in the manic depressive type we have most striking illustration of the serious disorder that occurs when the normal condition of stimulus and reaction is upset. By undue stimulation from overwork or extreme anxiety, and the like, apparently the normal resistance, perhaps the resistance at the synapses between the central nervous system in the spinal cord and the sympathetic nervous system is lowered, undue stimulation of the adrenals occurs, and as a result intense emotions are experienced. Then after the violent reactions to these emotions have expended the individual's energy, extreme depression may ensue, this being in part perhaps the normal reaction to the previous excitement and in part a vicarious functioning of the depressive emotions instead of the more violent ones.

Even in normal individuals over-stimulation may result in nervous weakness or nervous breakdown. This is illustrated over and over again in the soldiers who return from the war. Not only are those suffering from shell shock in a condition of nervous weakness and disorder for a long period until opportunity for reëducation has been given, but even those who come back apparently in normal condition without pronounced shock nevertheless are found for a period of perhaps some months after their return likely to be in such a condition of nervous weakness as the result of the prolonged stimulation of active service that they are not capable of performing their ordinary activities.

Again in many forms of nervous and mental disorder we have the phenomena of unmotivated fear, anger, and the like, the patient becomes violent at the slightest occasion, the slightest stimuli bring forth most violent reactions, in such cases there seems to be a general over irritability in the nervous tissue or else an abnormal functioning of the glands with internal secretion. Professor James long ago suggested that in such cases "We must suppose the nervous machinery to be so 'labile' in some one emotional direction that almost every stimulus (however inappropriate) causes it to upset in that way, and to engender the particular complex of feelings of which the psychic body of the emotion consists."

The cure of mental disorder when possible is brought about by something that reduces the abnormal stimulation. This in actual practice occurs in several different ways. The abnormal stimulation, if it be a poison or infection, may be removed by taking away the source of the poison, although in many cases this is an extremely difficult thing to do. Again the overstimulation from abnormal activity of some gland may be cured in some cases by removing a portion of the gland. Again in other cases it may be reduced temporarily by the administration of morphine; and again, in case of emotional overstimulation, this may be reduced in some cases by removing worry and anxiety; and by rest and sleep. Just as in the cause of mental disorder, stimulus and response represent a vicious circle and one involves the other, so in many cases cure may begin either by modifying the abnormal stimulation or by improving the faulty reaction.

Thus in most mental disorders if one would find the cause one must seek for some defect in stimulus and response. If one would prevent mental disorder, one must seek the means of preserving normal balance. The value of this mode of approach in mental hygiene and in the treatment of mental disease is obvious. It gives a simple method of making preliminary study of a given case and it gives an intelligent

view of the question whether anything can be done for the patient.

This may seem to represent hygiene as a relatively simple matter, it being merely necessary that one should have plenty of opportunity for work and an environment that favors normal reaction to stimulation, and the essential thing would apparently be merely to avoid over stimulation and overwork, on the one hand, and too little work on the other hand. A little experience, however, shows that even to do this is a difficult thing; and yet the question may naturally be raised why is it that the maintenance of an individual's health, especially one's mental health, is such an extremely complex affair. The answer is given by recent investigations.

With the evolution of the cerebral cortex the nervous system is no longer a mere mechanism for converting stimuli into reactions. The cortex makes association possible and the inhibition of instinctive reactions possible. The remarkable studies of Pavlov and his school[1] have shown that apparently with any stimulus whatever any other stimulus whatever may be associated and produce precisely the same physiological result; and furthermore, that the associated stimulus may even become necessary for the reaction. Kallischer has given socalled tone training to different animals, to monkeys, giving them food with a certain definite tone, and witholding it with other tones. Thus he habituated them to grasp the food only at the proper tone; that is, the tone associated with the giving and eating of the food. Another of these investigators associated a definite tone with the giving of meat, and with this definite tone the secretion of saliva would occur, but without this it did not occur. The discrimination of the dog is so acute that a difference in reaction was developed for even so slight a difference in the associated stimulus as a half or quarter of a note.

In the case of children it comes to pass that with the constant training received from the environment associated stimuli become potent, and soon the individual is governed, not merely by the simple biologically adequate stimuli of an ordinary environment, but by all sorts of artificial stimuli associated with the former. This it is that makes the training of children such a tragically complex matter; and this it is that accounts for the fact that the health of many children is precariously connected with many artificial conditioned stimuli.

In the ordinary behavior of an animal conditioned stimuli, as pointed out by Zéliony, are likely to be complex. The associated stimulus is not a single stimulus but rather a group of

[1] See an article on the conditioned reflex. Ped. Sem., Dec., 1917.

stimuli, or, as we should say, a situation. The experiments by Zéliony are especially interesting in this respect and they indicate that in such cases sometimes a single intense stimulus of the situation acts as a conditioned stimulus, sometimes two stimuli may be equally effective if they are of equal intensity, and sometimes the whole group of stimuli, or the whole situation, forms the conditioned stimulus.

In the case of the higher animals and children it is usually a group of stimuli, or a situation, which form the real stimulus, and reaction is usually to such concrete situations. In the whole of our behavior this is the fact, as has been clearly brought out by Watson and other psychologists. In the experience and education of a child all sorts of more or less artificial stimuli become associated with the primitive stimuli; and these must be studied to determine the hygiene of a child.

One of the strongest of the stimuli in an individual's environment is the presence of other human beings. A great part of the conditioned stimuli are likely to be of this social character.

The child in the group is a different individual from the same child alone. Working in the group he can do more work with the ergograph, he can turn a reel faster, he can add more accurately, he can remember better, and in general can accomplish more than the same child working as an individual.

The objective reality of the social stimuli has been made clear by modern scientific studies. Not only is it true that the presence of other individuals modifies the work and ability of an individual, but whenever significant social relations occur, the result is likely to be a reaction of the glands with internal secretion, and the emotional experience of the individual perhaps merely a concomitant or a result indirectly of the social events acting as direct stimuli to these glands. Crile is apparently quite right in classifying these as objective stimuli like the chemical ceptor stimuli.

It is not difficult to distinguish some of the social events which act as stimuli in the case of all normal individuals. That they are most simple and familiar matters indicates their significance. Among those where the proper balance between stimulus and response is specially significant for the mental health are the following:

(1) Any social event which threatens the life of an individual is of course a specially significant stimulus. If a man in sober earnest threatens to shoot you on sight, or, even if you receive anonymous letters threatening death, and conditions make one take this seriously, or if in any other way one's life be threatened, such an occurrence is a strong stimu-

lus. The normal reaction of course is activity of some kind, to destroy one's enemy, or to imprison him, or to protect oneself, or in rare cases, perhaps a philosophy that makes one reckless in regard to life. All men are susceptible to such stimuli.

(2) Any social event that threatens an individual's personal reputation is a significant stimulus, more effective in the case of most individuals than almost anything else. Shakespeare's character expresses the universal attitude,— "He that steals my purse steals trash, but he that filches from me my good name.....makes me poor indeed."

(3) Any social event that assails an individual along the line of the weak place in his character or personality. Every man has a certain residuum of character, whatever his social condition, and this is to him the vitally significant thing. Any event that threatens this or any event that threatens to weaken or destroy one's personality is an intense stimulus and brings about a strong reaction. Freud and Adler have given many illustrations.

(4) Among the higher and more complex stimuli, especially important are those which result from the anticipation by the imagination of future situations when connected with the belief that the latter will become real; or, in other words, the stimuli from expectation. Innumerable illustrations of the strength of such stimuli can be given. Every individual can furnish a multitude of examples from his own experience. Their significance is illustrated everywhere from our conversation about the weather to the formal pronouncements of the law courts.

A failure of things to come out as we expect, a change in the weather, the blocking of our plans by a friend, a *faux pas* on our own part upset us out of all proportion to the matters at stake. Too great a gap between anticipation and fulfilment is dangerous everywhere. Of this we have many illustrations alike in the great war and in the peaceful circles of domestic life.

If perchance things sometimes turn out better than we expect, our joy is again apt to be out of all proportion to the situation. We hail the result as a sort of atonement for hopes long delayed and disappointments long experienced.

This is a matter of everyday psychology. When we expect little and receive much; when we foresee evil, and good comes, "Oh! aint it a grand and glorious feeling!"

If the proper rhythm between expectation and fulfilment does not occur, serious results are liable to follow. In any case, the mental disturbance that results from such breaking of the rhythm of expectation and fulfilment is likely to be great.

From the social point of view the great stimuli in general terms are those from success on the one hand, and from failure on the other. Both for pedagogy and for hygiene these stimuli are of fundamental significance. No case could be cited perhaps that would better show the harmony between sound pedagogy and sound hygiene than the effect, upon the mental development and mental health of an individual, of success and failure.

The importance of failure in its relation to the mental health is not as obvious as that of success, and yet it is easily illustrated. The special danger with many children of superior talents is that by the ease with which they accomplish their tasks and by their superior accomplishments, and the fact that they always stand above their fellows, they acquire an undue estimate of their own ability and their own importance. They become egocentric in an extreme degree, and thus the germs of pathological egomania may be planted in the period of development; and innumerable cases have shown concretely the disastrous results that come in later life from such conditions. Many of these pathological or semi-pathological cases might have been saved by the wholesome stimulus from the discipline of failure, and a truthful estimate of one's own ability and one's own limitations in relation to the vastly greater importance of other superior individuals, and still more of the social groups of which they are members, would have saved them.

From the point of view of pedagogy it is the teacher's business at some time, in some subject, in some way or other, by some method or other, to give every child the opportunity for a noteworthy success. Of course this is specially important in case of the dull and mediocre child. On the other hand, perhaps equally important is the rule that every teacher should give every specially bright child at some time and in some way the opportunity to compete with other children that are superior and to attempt tasks that are specially difficult, so that such bright children may have the benefit that comes from failure.

That it is possible to arrange conditions so that each pupil may have a noteworthy success, and at least the bright pupils have the discipline of failure, has been indicated by practical work in the schoolroom; and some of the methods by which this can be accomplished are suggested by such studies as those of Moede.

Again, as Fröhlich (10) and others have pointed out, the school itself, and all the environment of school conditions, represent the stimuli to which children are subjected during the period of training. School work from this point of view

is a systematic attempt to regulate the conditions of stimulation and response in such a way that normal habits of mental activity may be developed.

We have seen that suitable stimulation and adequate response are necessary to healthful functioning. We have seen also that with the development of the cerebral cortex as the organ of association the possibility of stimulation is indefinitely increased. Not only the customary natural stimuli are effective, but apparently any impulse whatever from any receptor organ may become associated with the biologically adequate stimuli and produce the same response. This vicarious functioning brought about by association is not confined, however, to stimulation, it occurs also in reaction. This is illustrated in the simple forms of reaction. If I stimulate the thigh of a decapitated frog with a drop of acid, the animal raises his leg on the same side to brush off the irritating substance. If the leg is removed and the same stimulus applied, the animal no longer able to raise the leg on the same side raises that on the other side to brush away the stimulus. This simplest form of substituted reaction has its analogue in the higher processes. In some cases where normal reaction to emotional impulses is blocked, some other response associated naturally or artificially with the normal reaction may occur. The Freudians have given many illustrations of this, especially in cases of hysteria and the like.

The need of normal reaction to physical stimuli is clear; the danger from repression of normal reaction is obvious. The need of opportunity for adequate reaction to mental stimuli is not as clear. Failure of normal reaction to mental stimuli is more common perhaps than to physical stimuli. Education and social conventions in large part represent repression of natural forms of reaction; and it is only by training in habits of associated reaction that habits of mental health are acquired.

The great contributions of the Freudians to mental hygiene is not their doctrine of the Unconscious, but rather their convincing illustration of the universal need of adequate response to mental stimulation and of the injurious results of repression, and their demonstration of the practical value in many cases of sympathetic thinking about an emotional experience and analysis of mental states as a helpful form of reaction.

Practical Suggestions

The problem of hygiene is to safeguard an organism that depends for its life and health upon optimum stimulation and adequate opportunity for reaction. The limits of normal stimulation and response are relatively narrow. The funda-

mental impulse of the organism is activity. Every reaction may cause new stimulation. Placed in an environment of varied stimuli, overstimulation is likely to occur. Overstimulation increases reaction and over-reaction increases irritability. On the physical side, the thyroid stimulates the adrenals, and the adrenals react upon the thyroid to increase metabolism, and thus the kinetic drive with its vicious circle is established. The complexity of all this is increased when associated mental stimuli are involved. What can be done for protection? Nature devises many protections.

1. First of all it protects the organism by fatigue. All tissue susceptible to stimulation is subject to fatigue; and fatigue ensures rest. It is a well known fact that excitable tissue functions in rhythmic periods, a period of activity being followed by a refractory period, when the tissue refuses to respond. A single stimulus acting on the rested heart muscle produces a contraction. A second stimulus will not produce a contraction unless a certain period, of about 0.5 seconds in case of the frog's ventricle, has elapsed. The muscle needs this socalled refractory period to recover sufficiently to respond again. The nerve, too, in its electrical responses, shows a refractory period similar to that in the heart, but of much shorter duration. (18, p. 30.)

Again in case of the nervous tissue, the nervous mechanism especially involved in fatigue is admirably adapted to protect the inner and more vital parts of the nervous mechanism. In neuro-muscular fatigue, for example, the end-plate fatigues most quickly of all; and this serves as a protection to the more important parts of the mechanism. After the end-plate, again the synapse, the point of connection between the neurones, seems to be easily fatigued; and the fatigue of the synapse stops reaction and thus protects the more central nervous mechanism. The end-plate has been compared to a safety fuse in an electric motor and serves as a protection in case of most occasions for injurious reactions.

The human being is protected also by the conscious feeling of fatigue, or perhaps more accurately, by the ennui that precedes fatigue. It is only in great emergencies that we have opportunity to observe extreme fatigue in ourselves. The present war has furnished some of the best illustrations. These not only show that fatigue is a protection but illustrate the fact that in fatigue a greater stimulation can produce reaction.

A war correspondent[2] has reported a case in point. Of these soldiers he says: "When called on to make one last

[2] Herald-Journal, April 4, 1918.

effort after six days and nights of fighting and marching many of them staggered up like men who had been chloroformed, with dazed eyes and gray and drawn faces, speechless and deaf to words spoken to them, blind to the menace about them, seemingly at the last grip of strength.

"All my men are very cheery, but very tired," was the report of their General at a most critical time. "Being attacked," he says, "was the only thing that kept them awake. Towards the end of this fighting they had a drunken craving for sleep and slept standing with their heads falling against a parapet, slept sitting hunched in ditches and slept like dead men when they lay in the open ground, but they waked again when the enemy attacked once more, and fought him and killed him, and dozed off again.

The effectiveness of this protection is also illustrated by the report of the same correspondent. He says:

"In body and brain these men of ours were tired to the point of death. They were footsore and their limbs were stiff and they felt like old, old men; yet after a few days' rest they were again young and fresh."

"That is an astounding thing. Yesterday I went again among these Highlanders who fought so long and so hard, and upon my faith it was almost impossible to believe they were the same men. Their pipers were marching up and down the roads playing 'Highland Laddie' and other tunes of Scotland, and Gordons and Seaforths and Argyles stood about in the evening sunshine like men on the village green taking their ease in times of peace. Their kilts were dirty and stained, but they had washed off the dirt of battle, had shaved, and cleaned their steel hats, and the tiredness had gone out of their eyes and their youth had come back to them."

2. Nature protects the organism by habituation to stimuli. In its simplest form this seems to be a case of fatigue. A stimuli has its maximum effect the first time it acts. Thereafter its effect grows less and less. There is always this law of the diminishing intensity of response to stimulation. The law of summation of stimuli is no exception because that merely applies to small stimuli that are not sufficient to produce reaction. When a number of small stimuli have accumulated their effect, so that finally a response comes, the summated stimuli really form the first adequate stimulation, and any second application of the same has less effect. This law which appears first in the ordinary psychophysic law is valid throughout the whole realm of feeling and emotion. As Titchener and the other psychologists have put it, the feelings tend to dull themselves by repetition. This dulling is nature's protection against over-

stimulation, and its importance is seen in the psychology of everyday life and in all the great crises of life. It is this that gives the value to training, for the surgeon operating in the hospital, for the soldier on the field of battle, or the child learning adaptation to his environment. Innumerable examples of the law of the diminishing intensity of feeling could be cited. We may note the most recent and most obvious.

The war furnishes many illustrations of the law of the diminishing intensity of feeling. The soldier's training depends very largely upon this. The soldier becomes habituated to the noise of the cannon, to the various shocks of warfare and the like, and then ceases to be excited by them. The people in Paris were not seriously alarmed by long distance bombardment or the like because during the last three years they have become habituated to many and varied shocks and surprises of aerial bombardment and the like. If shells were thrown into Worcester in precisely the same way at intervals of quarter of an hour, a large part of the city would be in a panic, not because Americans are less courageous than Parisians, but because the Parisians have become dulled to such experiences. At the first aerial bombardment of Paris probably there was as much alarm as would be felt here. All of us were shocked at the first reported casualties of the war. Now we read of greater ones with what four years ago would have seemed heartless indifference. Thus the law of the diminishing intensity of feeling protects us from the incredible and apparently unendurable horrors of war.

Fear, rage, anger, pleasant and unpleasant feelings, moods of exaltation and depression, whether by means of the physical conditions correlated with them or by virtue of association with biologically adequate stimuli, are all effective stimuli in calling forth significant reactions. As indirect stimuli we may refer to social situations that call forth these feelings. Even the abstract ideas—glory, honor, country, home, democracy, freedom, duty,—we recognize as powerful stimuli; but we consider them all weak unless there is something beyond the abstract conception, unless they quicken the pulse, tense the nerves, and produce we know not how many physical changes, unless in popular phrase they "touch the heart."

Apparently they become symbols that act as conditioned stimuli because associated with the masterful feelings mentioned, and thus call forth significant physical results. As Loeb has expressed it, "since Pavlov and his pupils have succeeded in causing the secretion of saliva in a dog by optic and acoustic signals, it seems no longer strange to us that what the philosopher calls an idea is a process which can cause chemical changes in the body."

3. Coördinated action. As the diminishing intensity of feeling is due on the one hand to fatigue, on the other it is due to the elimination of unessential processes. As soon as the response to stimulation becomes coördinated, a minimum expenditure of energy occurs and a minimum of emotional disturbance. Thus all nature's training in response to stimuli gradually brings about this great protection.

In mental activity the rules of hygiene suggest protections against the trying situations of life similar to those nature has provided in the nervous system. First of all the dulling of the stimuli by repetition is always a good method of preparation. Wherever one has to encounter a trying experience, if it be possible to rehearse the situation beforehand it makes it possible to dull the stimuli. This has been the method used from the days of Aristotle's catharsis down to the preparation of the soldiers in the present war. The effort is made to habituate the soldiers to the trying experiences of trench warfare, the noise of the high explosives, the barrage, the bayonet charge, and the like.

Any form of coördinated activity serves as a protection. To adapt Professor James' classic statement of the case, if all the energy is utilized in coördinated action none is left to run down into the viscera and make a man afraid. Thus our soldiers in the thick of the fight say that they have no time to be afraid; and so in general as long as one can give attention one controls one's emotions. Hence it comes to pass that we devise all sorts of coördinated actions to serve as protection—from putting the hands in the pocket, lighting a cigarette, profanity, or what not, to more elaborate coördinated action in concentrating attention on one's work, or repeating a formula or a prayer.

Again is the protection that comes from knowledge. This of course is really protection by an associated idea. We all experience this in a hundred ways. If in a blizzard the gale strikes upon our windows we reflect upon the strength of the glass, the security of the bolts and the like, and feel no anxiety; and in every situation of extreme peril, if at once we know that our defense is secure, that at once checks the fear. As has been well said, complete knowledge would mean the entire eradication of fear.

If we may trust the investigations by Crile, they have shown, on the one hand, that the effect of the abnormal mental stimulation from worry and the like is precisely the same physically as that from the poison of infections; and, on the other hand, that the effect of the removal of worry and anxiety and habits of normal sleep is the same as that which comes from the removal of a portion of the abnormally active glands

by operation or from the giving of morphine. This has put a tremendous emphasis on normal mental hygiene, and it has shown that in both cases the cause of the mental disorder is to be looked for in the lack of balance between stimulation and response and the means of cure is again to be sought in the restoration of the normal balance.

Again, as associated mechanisms of protection, Crile has pointed out the protection that comes from our knowledge that worry itself is injurious. He and Dr. Cannon have both noted that this may serve as a distinct protection against injurious emotions. Dr. Crile says:

"The effect of fear, grief, worry and jealousy on the physical body is seen in the changes in the cells of the brain, the adrenals and the liver, and in the numerous resultant diseases and disabilities. Against man's inhumanity to man, religions and philosophies have been evolved, each of which aids in proportion to its power to substitute altruism for selfishness, to substitute faith for fear. Thus in understanding the physical basis of the action of faith and hope, as opposed to fear, despair, anger and grief, we have at our command a concrete force which can be efficiently used to protect the individual. As the knowledge of disgrace and punishment prevents dishonesty; as the knowledge of contagion prevents exposure to contagion, so the mere knowlege—the conviction—that excessive anger, work, jealousy, envy, worry or grief cause physical damage as serious as that produced by infections or crushing blows will constitute a powerful protection to man. The knowledge that these activations not only decrease the power of the individual to do his work, but ultimately cause numerous diseases as well, will result automatically in arousing the instinct of self-preservation, which will surround the individual with a protecting circle, through which anger, jealousy, grief, and worry cannot penetrate, just as the zone of local anaesthesia in the anociated surgical operation is an impenetrable barrier between the brain and the knife, making the surgical operation shockless." (7, p. 377.)

Lack of stimulation is quite as bad as over-stimulation in relation to health and development. Lack of change is lack of stimulation, and in the monotonous environment to which many by their daily tasks are doomed it is almost impossible to receive that stimulation necessary for health. Hence the various devices, resort to drugs, and the like, for relieving the deadly monotony.

In normal persons constantly subjected to the repetition of a monotonous life a positive need for stimulation of some kind seems to develop. This again is seen in noteworthy manner in the army where soldiers for a long period are subjected to the routine of camp life and the like; some means of recreation

seems to be absolutely necessary for the maintenance of the mental health; and as Leuba, Patrick, and others have attempted to show, this demand for relief from monotonous surroundings is one of the factors which lead men to seek change by the use of alcohol and other drugs; and Patrick even maintains that this demand is one of the factors leading to war among nations and causing the pleasure that most people take in strenuous games like football, which represent in miniature the serious habits of their ancestors.

"The need for relaxation by excitation," says Leuba, (16, p. 583.) "is so universal that means of gratification have everywhere, and at all times, been sanctioned by society. Sacred and secular festivals, to which various purposes may be assigned, but which serve primarily to refresh through relaxation, form a part of the order of every society. When the Faculty of Paris threatened to abolish the Feast of Fools, a petition was presented with the following argument: 'Wine casks would burst if we failed sometimes to remove the bung and let in air. Now we are all ill-bound casks and barrels which would let out the wine of wisdom if by constant devotion and the fear of God we allowed it to ferment....Thus on some days we give ourselves up to sport, so that with the greater zeal we may afterwards return to the worship of God.' When one means of refreshing the organism becomes impossible another is substituted."

Quite as bad perhaps are the pedantic habits of responding to small stimuli likely to be developed when no strong and varied stimuli are present. Students counting their steps to chapel or noting all the signs on the street, purists correcting the errors in grammer and punctuation as they read, Samuel Johnson touching all the lamp posts as he walked, are so many cases in point; and the best cure is apt to be a strong stimulus that absorbs all attention in a vigorous normal reaction.

The limits of normal stimulation and response are narrow. Hence it is very difficult to maintain the normal relations. The great danger to health in the conditions of modern life is that of over-stimulation, or of lack of opportunity for normal reaction, or of both. Of course it has always been true that there was this danger; and yet in the conditions of modern life this seems to be a peculiar danger.

Still more dangerous perhaps, especially in the period of development, is the lack of opportunity for normal reaction. The repression common in all education, both in the home and the school, the slavery to outworn and useless conventions in society, and the inhibition of normal and wholesome impulses by the limitations of poverty and monotonous daily tasks, furnish examples of the lack of opportunity for normal

reaction so familiar that concrete illustration is hardly necessary. Of pathological examples a multitude have been furnished by the psychoanalysts. In many cases all that is necessary is to give opportunity for some long repressed reaction to occur.

The Avoidance of Error.—The doctrines of hygiene have always been mixed with traditions and superstitions, and even the scientific history of hygiene is strewn with the fragments of exploded theories. The point of view here presented being in harmony with that of the other sciences would render the discoveries of science more readily available for hygiene and furnish protection from many errors. A few examples are instructive.

The whole history of ventilation, for example, has been largely the history of error. The errors in regard to CO_2 to which I have referred furnish one noteworthy example. The tradition in regard to the injurious effects of CO_2 is so strong that it seems to be very difficult to get the errors out of the textbooks, although for more than thirty years hygienists have known that the CO_2 even in the worst ventilated rooms does not seem to be injurious. We take the CO_2 as a gauge of the impurity of the air simply because it is usually in bad company. If an abnormal amount of CO_2 is present the air is usually foul for other reasons. It is merely a good constituent in bad company; for, as we have seen, a certain percentage of CO_2 is the necessary stimulus to respiration and a constituent of the blood absolutely essential to health.

Interesting also are the errors in regard to reinspiration of the air. (8, p. 451.) Some of the older writers asserted that the expired air is such a deadly poison that to rebreathe one's own breath a few times would prove fatal. More recently methods of ventilation have been devised with the aim of removing the expired air immediately from the face so that it cannot be rebreathed. The difficulty of displacing the expired air in this way is so great that probably all that most of these systems accomplish is to delay rather than prevent the reinspiration, so that the plan amounts really like other systerms of ventilation to mere dilution. The theory is erroneous, being based on the idea of chemical purity as the proper standard of ventilation and ignoring nature's method of ventilating the lungs by dilution. If some of the amateur hygienists could have their way children would die of apnea.

One is led to suspect that the medical profession has not been free from the delusion in regard to the dangers of reinspiration; for the old method of giving an anaesthetic by inspiration from a bag placed over the mouth and nose has been given up, although I am told that with the old method the cases of

surgical shock were much fewer, perhaps on account of the stimulus to respiration from the greater amount of CO_2 inspired.

Especially in regard to these common matters of daily life does error seem to prevail. A remarkable example is the current doctrine in regard to food. The vagaries in regard to diet are legion. Even the scientific studies have concerned chiefly the different food elements required and the amount of each for individuals of different age and occupation. Balanced diets and rules for eating have been worked out with great care, but children still often fail to thrive and adults still suffer from indigestion. We are just beginning to see the importance of studying eating and digestion as response to stimulation; and, thanks to Pavlov and his school, we find that digestion waits on appetite and that appetite depends on proper stimulation.

The effect of varied and attractive diet and pleasant surroundings may be referred to as the effect of suggestion; but it is a very potent and subtle form of suggestion, and it seems to apply to animals as well as men. Dr. Pearl reports that a colony of rats that did not thrive on the most approved scientific ration, improved remarkably when given access to garbage. He reports also from his own investigation an experiment with hens. One flock was fed the most correct chicken diet known, containing every necessary element in the right proportion, all placed together in one bin. In case of the other flock each kind of food was put separately in a bin by itself, and the hens were free to eat much or little from any one of the bins. "The results of this experiment," says Dr. Pearl, "were really startling. The hens fed on the pick-and-choose system not only gained more flesh and laid more eggs than those fed on the unvaried ration, but they also ate very much less food—thirty per cent less fat and thirty per cent less protein, to be exact." (23)

Apparently, whether in men or animals, the more the process of eating assumes the character of a mechanical task instead of voluntary response to stimulation, the less the value of the digestion that follows.

In the hygiene of the nervous system perhaps especially many errors have prevailed, because it has been regarded, not as a vital physical organ, whose healthful development and preservation depend upon vigorous and regular functioning, but rather as a storage battery weak and fragile with a limited amount of potential energy to be most carefully guarded and conserved. As a matter of fact the nerve tissue is one of the toughest things in the world when given the opportunity to function naturally in rhythmic periods of storage and explosion

of energy. An insight into the fundamental principle of hygiene would have saved hygienists from the error, on the one hand, of thinking that nerve substance is above physical laws and capable of functioning indefinitely without fatigue, and from the fatal practice of working when over-fatigued, and, on the other hand, from supposing that the only thing necessary is care for rest, the storing of energy, and economy in expending energy, while ignoring the need of vigorous explosion of energy as a necessary condition of the normal building up processes in a succeeding period of rest.

While most psychiatrists have now come to see the need for nerve rest and the storing of energy, many still fail to realize the importance of the normal expenditure of energy.

Hygiene has been slow to learn the truth from other sciences; and sometimes error long prevails in spite of truth established in chemistry and physiology. The scientific results found in other sciences should, however, be made quickly available, and there is no excuse for the prevalence of error after the truth has been found; hence the need of a new point of view in hygiene, that will make it less easy to fall into the traditional errors and more easy, on the other hand, quickly to adopt the results of modern scientific investigation. Accordingly the attempt has been made here to present such a point of view.

Conclusion

In developing this fundamental principle of hygiene we have likewise developed its fundamental method. While for hygiene it is necessary to avoid over-stimulation, and, if it be possible, overreaction, modern hygiene is positive rather than negative, and it puts the emphasis on exposing the organism to healthful and necessary stimulation and on development of habits of healthful reaction in the widest sense.

We thus see the practical harmony of the method of hygiene and the method of education. Education consists in developing certain instinctive reactions and habits of reaction based upon these, certain attitudes and interests. Teachers are slowly discovering that the only way this can be done is by placing pupils in situations where they will be exposed to certain stimuli with full opportunity to respond. This fundamental principle and method of education and the errors that result when this is ignored have been well expressed by Professor Hocking of Harvard in his recent volume upon "Human nature and its remaking." Noting that in developing a child's instincts exposure to stimulation that may appeal to him is the first work of education, Professor Hocking adds:

"If we were dealing with an organism whose instincts we did not know, the educing process would consist in exposing that organism, much as one would expose a photographic plate, to various environments to see which ones would elicit reactions. And in dealing with a new human being, always unknown, the work of educing his instincts would likewise consist in *exposing* him to those stimuli which may appeal to him,—to speech, to things graspable or ownable, to color, form, music, etc., to the goods of cleanliness, truthfulness, and the like. What powers any child has of responding to these things, whether or how far they will *take* in his case, neither he nor we can know until he has been exposed—and perhaps persistently and painfully exposed—to specific examples of these goods. . . .

And the first peril of education is not that the child's will will be overborne, but that through no exposure or inadequate exposure to the objects that would call out his best responses, he achieves only half a will instead of a whole one, a will partly-developed and therefore feebly-initiative, casual, spiritless, uninterested. If I were to name the chief defect of contemporary education, it would not be that it turns out persons who believe and behave as their fathers did—it does not; but that it produces so many stunted wills, wills prematurely gray and incapable of greatness, not because of lack of endowment, but because they have never been searchingly exposed to what is noble, generous, and faith-provoking." (14.)

From our present point of view it is not strange that education, in the sense of exposure to normal and varied stimulation, is the fundamental method of hygiene; and that re-education is often the best means of cure in both physical and mental disorder.

Thus the fundamental aim of hygiene is the development of normal function; the fundamental principle, the maintenance of an optimum stimulation and reaction; the fundamental method, the exposure to normal stimuli, with opportunity for complete reaction.

The tentative formulation of our principle which we used at the outset may now be modified to read as follows: The health of an organ depends upon optimum stimulation and response and the proper balance between the activity of the given organ and the activities of other related organs. By stimulus is meant any change internal or external that affects the organism; and by response any reaction physical or mental.

What constitutes normal stimulation and response must be determined by long and careful scientific investigation. At present our concrete knowledge is small. Thus hygiene is rightly called the science of the future. But the principle here formulated puts hygiene in harmony with other sciences, it gives the right point of view, it helps protect the student from error. And by the well-established rules of scientific method, of first hand observation, induction from experience, and verification, we may expect the future science will be built.

This simple outline has of course ignored the conditions that complicate the hygienic problem of stimulation and response—varying degrees of irritability in the nervous tissue, individual differences in sensitiveness to stimuli, the modifiability of tissue by response, reserve forces in the nervous system, and the many conditions, internal and external, that affect stimulation and response. Some of the facts in regard to these conditions are especially important for hygiene, but they form another story that cannot be told here.

If the goal attained after our long discussion is disappointing because it is merely our starting point, it is no small gain to see clearly that the aim of hygiene is positive and not negative.

The great fundamental error of the older hygiene was in looking upon its function as negative, the mere combatting of the enemies to man's health. Of course hygiene does seek to remedy injurious conditions, but the aim of modern hygiene is essentially positive, to keep the proper balance of internal forces and functions, and to keep every organ of the body in normal activity. Irritability, normal metabolism, function, the power to work, are the conditions of health everywhere from protoplasm to man. Modern hygiene aims at the most efficient function, the most complete development, it aims to raise the health level, to make an individual immune to disease, and to develop habits of health. While searching for further knowledge the practical task of hygiene is to apply the concrete facts already established.

Again the study of this fundamental principle of hygiene suggests the method by which we may hope to build up a science of practical hygiene. Just as the new pedagogy founded by Comenius studies nature to find the principles of sound education, so modern hygiene should study nature's methods of protection to determine the principles of hygiene.

The limits of normal stimulation and response are, as we have seen, relatively narrow, but nature devises all sorts of protections against undue stimulation and abnormal reaction. In the first place nature protects the organism in large degree from injurious stimuli. The eye is protected from mechanical agents by the reflex closing the eyelids and from too intense light by the curtain of the iris. The nose protects from injurious stimuli from foreign bodies, extremely cold air, and the like; the skin itself protects all the nerves of touch; and the most important part of the nervous system is protected by the solid box we call the skull.

Again nature protects from over-stimulation by fatigue, as is illustrated in noteworthy manner by the adaptation of the retina of the eye to seeing in the light. This apparently

is a phenomenon of fatigue. We see in the sunlight without injury because while in the light the retina is permanently fatigued.

Still further nature protects from all the injurious stimuli that enter the organism. Against bacterial infection she provides anti-bodies and antitoxins and develops some form of immunity against all toxic agents.

What seems to be the general law has been expressed by Dr. Welch as follows: "The struggle between the bacteria and the body cells in infections may be conceived as an immunizing contest in which each participant is stimulated by its opponent to the production of cytotoxins hostile to the other, and thereby endeavours to make itself immune against its antagonist."

Perhaps equally significant are nature's methods of protecting the organism against abnormal response to stimulation. The stimuli to growth from the thyroid and other glands are held in check by the secretion from the pituitary gland thus preventing over growth and giantism. The most vital organ, the heart, is protected from over-response to stimulation by the inhibitory action of the vagus nerve; and the deeper and more vital portions of the nervous system are protected from over-reaction by the fact that the peripheral end-plates are easily fatigued.

Thus if the methods of hygiene are to be natural and efficient they will aim to remove injurious stimuli as far as possible, to protect against abnormal stimulation by the development of immunity, to prevent habits of abnormal reaction by developing habits of coördinated activity that are hygienic; and in mental hygiene to protect from over stimulation and abnormal reaction by analogous methods.

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THE DIAGNOSTIC FALLIBILITY OF INTELLIGENCE RATIOS*

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The use of intelligence ratios as an aid in the diagnosis of feeble-mindedness is the outgrowth of a very recent statistical trend in clinical psychology. Just how far this usage may extend one can hardly predict, but a brief exposition of the fallacies involved in any such procedure is surely timely and necessary in the interest of the individual who is diagnosed by such a method. It is also advisable for the protection of social agencies which have to deal with children who have been so diagnosed.

When tests evaluating mentality in terms of mental age were first adopted the ordinary procedure was to determine the child's mental age, compare it with his actual chronological age, and thus ascertain the amount of mental retardation or acceleration, expressed in terms of years of mentality. Over two years of retardation was considered as evidence of feeble-mindedness when the child examined was actually less than nine chronologically. Over three years of retardation was accepted as equally significant in a child over nine years of age. Binet (1), himself, presented this method. He defined idiocy as development corresponding to that of birth to 2 years, imbecility as equal to 2 to 7 years of development, and moronity as beginning at the mental age of 8. He does not define the upper limits of moronity in terms of years, but says it lies below the upper limit of his 1908 scale. No child would, however, be placed in any one of these classified groups unless he were definitely feeble-minded and tested at least two or three years below age. Even then, Binet (1) writes: "It is understood that these diagnoses apply only to the present moment. One who is imbecile today may, by the progress of age, become a moron, or on the contrary remain an imbecile all his life. One knows nothing of that; the prognosis is reserved" (p. 270). Goddard (5) defines the usage of the mental age in similar but much more definite terms, writing, "It has been found that if a child is more than two years

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backward while he is still under nine years of age, he is probably feeble-minded. For a child above nine, we allow him more than three years backward before we call him defective" (p. 86). At first conservative usage generally interpreted this to mean that four years of retardation were equivalent to feeble-mindedness. Goddard (7), also, uses it in this fashion in estimating the percentage of feeble-minded children found in testing an unselected group of public school children. These two ways of stating the same thing have, however, led to some confusion in the interpretation of various authors where the exact usage is not always stated.

It will be seen from the above statements from Goddard and Binet that the usage of a mental age without reference to the subject's actual age is not to be condoned, while diagnosis depends not only upon the relativity of the two but also upon the actual chronological age at which such a ratio of mental and chronological age occurs.

Gradually during the last five years there has appeared a tendency to disregard this last factor of the actual age of the child at the time of examination and to classify him diagnostically by the use of some ratio expressing the comparison of his mental and chronological ages. Intelligence quotients, mental quotients, coefficients of intellectual ability, and even "absolute" intelligence ratios have been suggested. To one who is practically engaged in clinical work all of these modifications seem to be an outgrowth of a feeling that the tests are non-diagnostic, or rather that they are not sufficiently so. Each suggestion that findings be treated in this or that way indicates another attempt to make the tests express infallibly and in careful decimal fashion not only differential diagnoses but also prognoses.

Binet saw this difficulty and emphatically stated that the tests are by no means a substitute for the expert in the study of children. He also states that the test level is diagnostic and that "prognosis is reserved," but few of our American writers seem to see the relation of his clear statements, based upon the experience of evolving the scale, to their use of it in clinical fashion.

A mental test by any one test series has, presumably, as one of its immediate purposes, the ascertainment of a mental age. If this mental age be translated into a decimal of the amount the child should do, it becomes what Yerkes terms an intelligence coefficient; if it be translated into a decimal indicating his mental age in relation to his chronological age, it becomes what Terman calls an intelligence quotient and what Stern termed a mental quotient. Otis goes even farther and would attempt to ascertain a child's absolute grade of brightness,

compare it with the absolute grade of brightness for his age, and thus obtain an "absolute" intelligence quotient which would, theoretically, enable us to "predict the probable maximum intellectual attainments which he will achieve" (2, p. 140).

The use of any of these ratios, or of the consideration of mental age in relation to chronological age, may then serve two purposes. It may, first of all, classify a child with others of a group doing a similar proportion of normal requirements. In this sense it is diagnostic of present mental level. It is sometimes used to indicate the child's probable future development and in this case it is prognostic. The simplicity of classification by any of the various scales has led to a very general acceptance of the attitude that this differentiation of prognosis and diagnosis is unnecessary, that the two are identical. A child tests at age on the scale now; he is therefore "normal" and will remain "normal." The first application of the term "normal" is diagnostic of the child's present level compared with the level of other children of similar age. The second usage of the term is the result of the inference that once normal always normal. The term implies that, and the inference would be correct were our first diagnostic statement based upon an absolute knowledge of normality. Instead it is based upon a very poorly standardized group of "averages." This prognostic usage is also encouraged by the fact that a classification of any child as feeble-minded has embodied in it the actual prognosis. But even this interpretation is not infallible. The child who tests at age may be normal, defective or psychotic. The child who is more than three years retarded is surely not normal but he may be demented or feeble-minded, or both. The mental age in the second case removes one possibility, that of normality or average endowment, but it leaves three other possible conditions which differ greatly but which no mental age, coefficient, or intelligence quotient, taken alone, can indicate. So far the possibility that the child whose mental age indicates abnormality is insane or a predementia seems to have been almost entirely overlooked. Diagnosis, prognosis included, has been made quantitatively, irrespective of quality of responses. This practice has led to some most conflicting statements regarding mental tests and their application, all of which cannot be true.

Stern (12) was one of the first to propose the use of a ratio for diagnostic purposes. He found years of retardation difficult to handle because the number of years of retardation was different for children of different ages where the mentalities might be the same. He consequently proposed the "mental quotient" or the ratio of the mental age to the actual or

chronological age. He defines as feeble-minded all those with quotients below .80. He does not find the quotient entirely satisfactory, however, as it fluctuates on growing children, varying even in the individual from time to time.

The suggestion was nevertheless taken up in this country and has been much in favor with two groups of workers, best represented by their respective leaders, Yerkes and Terman. Yerkes devised the coefficient of intellectual ability, or the number of points a person scores on the Point Scale, divided by the number of points a person of his age should score. He, too, finds that there is a great deal of fluctuation in such a ratio (17), and that it is consequently not wholly reliable. He gives a tentative classification for its use, despite this unreliability, calling those dependent who have a coefficient of .50 or less; those inferior who range from .51 to .70; those subnormal who have a coefficient of .71 to .90. Haines (8), Rossy, and others uphold the use of this method or of some modification of it. Kuhlmann (9) was probably the first man in this country to advocate the use of some such quotient but his work received very little recognition until taken up by Terman (15) and employed as an integral part of the Stanford Revision of the Binet-Simon Scale. He undoubtedly believes in the prognostic value of the intelligence quotient for, acknowledging the need of supplementing "the social criterion (of feeble-mindedness) with a more strictly psychological one," he adds, "For this purpose there is nothing else as significant as the I Q. All who test below 70 I Q by the Stanford revision of the Binet-Simon scale should be considered as feeble-minded and it is an open question whether it would not be justifiable to consider 75 I Q as the lower limit of "normal" intelligence. Certainly a large proportion falling between 70 and 75 can hardly be classed as other than feeble-minded, even according to the social criterion" (13, p. 81).

Because of this Terman does not apply the I Q with extreme rigidity, but recognizes a borderline group which he defines as "those which fall near the boundary between that grade of mental deficiency which will be generally recognized as such and the higher group usually classed as normal but dull." He continues "It must be emphasized, however, that this doubtful group is not marked off by definite I Q limits. Some children with I Q as high as 75 or even 80 will have to be classified as feeble-minded; some as low as 70 I Q may be so well endowed in other mental traits that they may manage as adults to get along fairly well in a simple environment. The ability to compete with one's fellows in the social and industrial world does not depend upon intelligence alone.

Such factors as moral traits, industry, environment to be encountered, personal appearance, and influential relatives are also involved. Two children classified above as feeble-minded had an I Q as high as 75. In these cases the emotional, moral, or physical qualities were so defective as to render normal social life out of the question. This is occasionally true even with an I Q as high as 80" (13, pp. 87-88).

Even to the uncritical reader it must be apparent from these statements that Terman places 80 as the very highest limit of I Q for even a borderline defective. This interpretation is re-enforced by his statements regarding those whose quotients run between 80 and 90, where he places "those children who would not, according to any of the commonly accepted social standards, be considered feeble-minded, but who are nevertheless far enough below the actual average of intelligence among races of western European descent that they cannot make ordinary school progress or master other intellectual difficulties which average children are equal to" (13, p. 92). He also states that they have found only one exceptionally intelligent child who appeared feeble-minded. He is ten years old with an I Q of 125 and he is described by Terman as "a case of disturbed emotional and social development with superior intelligence." Of course this reliability of the intelligence quotient holds only for the Stanford revision of the scale, but on it he feels it is quite dependable for he adds, "Since the distribution of I Q's remains practically the same at all ages from 5 to 14, it is evident that the usual method of expressing intelligence status in terms of years of retardation or acceleration is misleading. 'A year of retardation' is a unit which has no constant value. A year of deviation at age 6 is exactly equivalent to a deviation of 18 mos. at age 9 and to 2 years at age 12, etc." (15, p. 557). He acknowledges that it is necessary to test children several times in order to be sure that their I Q's are constant and he does not feel that the repeated examinations of children by examiners who were not using the Stanford revision are data which may be relied upon for they "involved the use of a very imperfect scale, the worst feature of which is that its inaccuracy is unequal at different age levels" (15, p. 557). Recently he has repeated these assertions although he has slightly modified his statement by acknowledging that the I Q's of feeble-minded children "tend to decrease considerably" (14, pp. 55-56).

Emphatic endorsement of the coefficient of intelligence, the intelligence quotient or other exact numerical rating used clinically seems practically confined to the two groups of workers represented by Yerkes and Terman. Criticism of these ratios and of the things for which they stand has also

come chiefly from two sources, that is, from Wallin and from those workers who may be grouped together as having been trained under Goddard. Wallin strikes the right line of criticism when, by a fair use of the intelligence quotient, he shows that *on the average* the I Q is higher for normals than for morons, and that indeed "the intelligence quotient decreases with each descending category of intelligence" (16, p. 265), but that it overlaps greatly for the individual cases in the various categories. It is the old fallacy of applying a median or a mean to the individual and then finding fault with him when it does not fit. Wallin advocates a conservative use of all methods of diagnosis and shows that the problem of the I Q is far more complicated than Terman would have us believe for not only the I Q of the defective, but also the I Q of the normal child tends to fall as he increases in age, even before he reaches the teens.

The Vineland attitude is usually thought of by those who are not acquainted with the laboratory itself as holding closely to the views expressed in the first articles which, emanating from there, first acquainted American workers with the work of Binet. A child more than three years retarded was considered feeble-minded, all others were not feeble-minded. But neither Goddard or his students have ever kept to any such a hard and fast interpretation of numerical results. Goddard (6) reported in 1913 that "there are some indications, however, that some children are pretty nearly normal until about eight or nine years of age and then they stop rather suddenly. For example, children test normal at six, and defective at ten, never having developed beyond seven" (p. 125). Because of this he at that time raised the question as to how the child reaches his point of arrested development. Some children seem to reach it abruptly and others slowly show retardation.

From the very beginning of re-examinations by the first year scale the Vineland records began to show the child who tested "at age" and who then began to lose standing mentally. The experience with these cases has been reported by Doll (2, 3, 4) in his articles on potential feeble-mindedness. A potentially feeble-minded child is one who is actually feeble-minded but he does not test sufficiently below age by the mental tests to fit the mathematical definition of 3 or 4 years of retardation. Time shows that he has reached his limit of mental development and he gradually becomes one, two and then more than two years retarded. These children cannot be called borderline cases for we are too generally using that term to designate the case who is so high-grade that it is doubtful whether he is or is not feeble-minded. The borderline cases

are adolescent or older and test high on the year scale. These potential feeble-minded children are comparatively young, of any age up to thirteen and they need not necessarily prove to be morons. They have simply happened to be examined before their actual inferiority has had a chance to show itself. Such children when examined in a clinic where the I Q or a coefficient of intellectual ability is used as the basis of diagnosis will be classed as normal one year, backward the next year and feeble-minded a year or two later. Unfortunately this actually happens. In the time between the diagnosis of normal and that of feeble-minded, social agencies, teachers, courts and homes have to deal in a disheartened way with the inferior material handed over to their care. Only too often they, and not the clinician, are blamed for the lack of good results.

If the potentially feeble-minded child exists in even moderate numbers, then I Q's cannot remain constant. Terman would probably reply that it is the use of an imperfect scale which has brought about this seeming disturbance of test values and that the situation will clear up with the use of a more perfect test series. We might try to show that if such criticism applies to the old scale when used in testing feeble-minded children, whose I Q's decrease, it would also apply when testing normal children, whose I Q's remain constant despite the variation of the scale. These children would undoubtedly have varying I Q's on a scale where the I Q's of the feeble-minded remained constant. Instead, however, of following any such line of argument let us assume the irregular formation of the Goddard revision. The scale may be harder at one point, easier at another, yet for children who are tested on the same part of the scale the difficulty should be just as exactly comparable as on a scale that was exactly graded. Consequently, if we take a group of children who are all of the same mental level, have the same I Q and, hence, the same chronological age, we ought to be allowed to expect equal development of them on the scale. The I Q's they achieve may vary on different parts of the scale, according to the difficulty of that part, but the variation should be approximately the same for all of them or else the assumption of I Q permanency is false. It may be possible that the average child will be found to have an I Q of 120 at the age of four on the Goddard scale, an I Q of 110 at the age of seven, of 100 at the age of nine, and even less above that age. A gradual decrease of this sort would then be the norm to be expected of all children who at the age of four had I Q's of 120. These figures are merely suggestive for as yet little has been

done with the problem of following the average child through a long enough period to see him safely above the limits of possible feeble-mindedness.

The writer has been interested in following such development with clinic and institutional types where the first findings were not sufficiently conclusive to allow of diagnosis. In a large part of this work the only scale available at the time of the first observation (because of the recency of the Point and the Stanford) was the Goddard revision. In some cases it was the only scale available for the first two or three years of the continued observation on the child. Because of this, and in order to meet any criticism of the scale used, it will be necessary to study the children who at some one age had the same mental age. These children would thus have the same, or approximately the same, I Q's and theoretically the same chance for future mental development. The largest group which is available for such study consists of the children who when first seen and studied were between their seventh and eighth birthdays. During the past two years fifteen children of that age who tested normal when first seen have been intensively studied in the Waverley laboratory. These children were taken into the institution on observation or sometimes on a regular commitment after having been under observation. It is of this group that I wish to treat in detail, for experience with them has not shown that they are uniformly dull normals, progress with even similar I Q's, nor are to be classed under any one diagnostic heading at the present time, or, indeed, at similar intervals after their first examinations.

When first seen these fifteen children ranged in chronological age from 7 years 0 months to 7 years 11 months. Their mental ages by the Binet-Simon scale ranged from 6.8 years to 7.8 years, their I Q's ranging from 93 to 103, only one being as low as 93 and all of the others being 96 or more. Terman claims that the Goddard revision is easier than the Stanford and finds as much as ten points of difference in the I Q's of seven year olds on the two scales. Since he designates an I Q of 80 on the Stanford as the upper limit of feeble-mindedness, an extra allowance of ten points on the Goddard revision would probably be the most he could demand as an I Q criterion of feeble-mindedness at the age of seven, for this is his own scale comparison. That would give an I Q of 90 as the highest probable score of a seven year old feeble-minded child. With even this rather lenient correction all of the children in the group mentioned above would fall completely outside the limits of such a classification for feeble-mindedness.

The continued observation of these fifteen children has been

rather enlightening. At the present time the youngest child of the group is 7 years 4 months old and the oldest child is 12 years 2 months of age. The variation in age is due to the difference in the length of time they have been under observation. Their mental ages by the same revision of the Binet now range from 7.0 to 10.4. The I Q's now range from 70 to 99, with a median at 86. In general the decrease in the ratio of mental age to chronological age is greater the longer the time the child has been studied, but this is not uniformly the case. One boy changed his I Q but one point in two and a half years, that point was gained. Another lost three points in the same length of time, while a third child lost ten points and another twenty-four points in a little less than three years. This does not look as though the I Q were at all stable even with children of the same age who were once similarly endowed, so far as the tests could show endowment. Fortunately, two of our boys were exactly the same age when first examined (7 years 10 months) and tested exactly the same (7.8) on the scale, I Q's both being 99. The one was re-examined recently at the age of 10 years 0 months and tests 8.2 years, I Q 82. The other was re-examined at the age of 10 years 3 months and scored 9.8 years with an I Q of 96. At the time of the last examination both children were given the Stanford scale also. The former tested 7 years 6 months, I Q 75, the latter scored 10 years, I Q 98. The former is a definitely feeble-minded boy, the latter is not, yet they were both testing at age when nearly eight years old. These two children illustrate graphically the difference between a potentially feeble-minded child and one who now seems to be potentially normal.

It would be erroneous to attempt a direct comparison of the change in the intelligence quotients of all of these children. Some of them have been studied far longer than the rest and have had far more chance to show latent retardation. One child has gained one point on his I Q, all of the rest have lost, the loss ranging from 3 to 31 points. If these changes be evaluated on the basis of probable loss per year (and this is an arbitrary procedure, for we have no means of knowing whether the loss is regular) the variation ranges from almost no change to at least nine points of change in one year. This must undoubtedly be individual variation and cannot be due to the arbitrariness of the scale. If those who slow up on the scale are to be counted as having done so because of test difficulty, then those who have kept I Q's which are practically constant have in reality become precocious, the original grouping by the tests is still non-prognostic. Following is a comparison of the

mental status of these children upon their first examination and now, together with Stanford I Q's made at the time of the last examination.

	First observation				Last observation			
	Chron.	Mental			Chron.	Mental		Stanf.
Name	Age	Age	I. Q.		Age	Age	I. Q.	I. Q.
Daisy	7..0	7.2	103	(90)	7..7	7.4	97	97
James	7..6	7.6	101		12..1	10.4	85	92
Redman	7..9	7.6	98		10..4	10.2	99	91
Wharton	7..10	7.8	99		10..3	9.8	96	98
Harter	7..11	7.4	93	(88)	9..2	8.0	87	79
David	7..5	7.2	97		11..5	8.2	70	68
Charles	7..5	7.6	102		10..11	7.8	71	67
Helen	7..1	6.8	96	(86)	8..8	7.8	90	83
Ruby	7..4	7.2	98		10..3	7.6	74	68
John	7..6	7.2	96		10..0	8.6	86	82
Michael	7..7	7.2	97		12..2	9.0	74	63
Grace	7..10	7.6	97		8..10	8.0	91	87
Philip	7..10	7.8	99		10..0	8.2	82	75
Norman	7..0	6.8	97	(86)	7..11	7.4	94	78
Baron	7..3	7.4	102	(99)	7..4	7.0	96	90

In several of the cases the Stanford was given the first time they were examined. The I Q's for these examinations are given in parentheses beside the other findings from the same examination.

Some of these children have not settled themselves definitely into one category or another but there is not a "straight" normal or a dull normal among them. The observation of these children has proven conclusively to the writer that it is as impossible to prognose from one test the line of development to be expected from an atypical normal-testing child as it is to determine the direction of a straight line from one point. The truth of this statement may become more evident if we study some of the children individually.

Daisy has been under observation only seven months. She is "in process of prognosis." She tests practically normal, that is, at age, is responsive, over imaginative and interpretative and gives a good impression because of her readiness to talk. She is unanimously reported, however, as the "silliest thing imaginable." She seems to spend most of her time giggling or contriving to act silly, no matter what the situation. She tries to dominate the other children and succeeds fairly well although she is not especially liked because of her bullying. She steals, lies, masturbates, exposes herself, enjoys obscene expressions and stories that are far from nice. She is easily excited and is quite passionate. She learns fairly well under various sorts of instructors, but not so well as one would expect from a child who is as mentally active as she seems to be. By supplementary psychological tests she seems

to have coordination average for eight year old development, but she is very poor in even imitative learning and almost non-adaptive to very simple situations. She learns very slowly on conditioned reflexes, unlearns and modifies her reaction too quickly and re-adapts very slowly. This relation of processes is that usually found in psychopathic children (10). Taking into account that her father was alcoholic and a sex offender, while her mother is sexually promiscuous, there seems to be sufficient grounds for doubting her ability to become a normal-subsisting adult. She may be a high-grade feeble-minded girl or she may develop an actual insanity but so far one can not say what will happen.

James has almost reached the point where his actual mental development will show no possibility of his being feeble-minded, but he is not "normal" despite his mental age. His father reports that he has "always been peculiar." He had convulsions up to the age of four and never learned to walk until about that time. His use of speech was also delayed. He had violent temper spells from the time he was a baby until the age of seven. Since that time he has been under institutional supervision and has been getting along well, although he was very slow in learning until last fall. About that time he suddenly seemed to wake up, did much better school work, was a leader in gymnasium, and showed his reliability in shop work, too. At that time he was 11½ years old and tested 10 years on the Goddard Binet and 8 years 8 months on the Stanford, with I Q's respectively 87 and 75. Today he tests 10.4 on the Goddard Binet (I Q 85) and has reached a part of the scale where only minimum progress can be made. On the Stanford he tests 11 years 2 months with an I Q of 92. Both examinations were made by the same examiner and there is no question of the actual change. James himself says he knows more and he proves it on all of the supplementary tests, jumping from trial and success procedures to the reasoning and deliberate methods which we expect only from adults. However, he does not seem normal. He often has dull days when he complains of headache and pain, says he cannot sleep at night and one notes that even at playtime, on those days, he will sit still, simply watching the other children. Between these attacks he is merry, alert, inventive in games, eager to do anything suggested to him. Here again the diagnostic level of the tests is non-prognostic but leaves one wondering what the next two or three years will bring of epilepsy or a psychic equivalent, improving mentality, retardation or degeneracy.

Redman, too, is a case so far unsettled. He tests just about normal and has, ever since he was first examined. He comes

from a neuropathic family. His father is alcoholic, dishonest, unreliable, and deserted the family. The father's relatives all seem reputable and highly intelligent. The mother is seemingly an earnest, responsible woman. The other children all got along well under the home conditions but Redman became unmanageable about the age of two years. Later he stole, lied, could learn in school but could not be kept there because he was cruel to little girls, thumped them unmercifully and without reason, was obscene in his tendencies and in general a problem. A younger brother was a Mongolian idiot.

With changed environment Redman does well, learns well in school, is quiet, well-behaved, an attractive, normal-appearing and lovable little boy, although normally curious and mischievous. He is rapidly aproaching such a mentality that there can be no possible thought of his being feeble-minded. He is, undoubtedly, of a neuropathic predisposition and needs the best of external conditions to keep him functioning in a normal fashion.

Baron has been under observation less time than any of the others in this group. When first examined he was 7 years and 3 months old and tested 7.4 on the Goddard Binet, 7 years 2 months on the Stanford, with I Q's of 102 and 99 respectively. He came to us with a history of cruelty to other children, of killing animals for the joy of it, of destructiveness with toys and clothing. He is absolutely fearless and "likes blood." He cannot be made to obey either at home or away from it. When one finds in his family history the fact that both his father and his paternal grandfather have suffered from Hebraische Krankheit, or a progressive gangrene of the lower extremities, it puts even a graver aspect on the situation. Baron, himself, already gives evidences of neural disturbance. He is decidedly lacking in motor control, has delayed reactions, a definite nystagmus, cannot hop on one foot, staggers in walking, etc., but his reflexes are normal. He has been absolutely unable to learn anything in school except counting and the spelling of a few words like *the* and *you*. When asked to read a sentence such as *Come and see me,* he reads "Rain go away, come to me another time," applying the verses he has learned in rote fashion regardless of the text. He can print his first name and says he can write. He does this by writing I C U and reading it "I see you."

When re-examined a month after this first observation, under even more favorable laboratory conditions, he fails to do even as well as the first time, although his previous acquaintance with the tests should have been a help to him. This time he tests 7.0 by the Goddard Binet and only 6 years 8 months by the Stanford, I Q's 96 and 90 respectively. Nor is the

difference due to a different evaluation of similar responses but there is a distinct difference in the quality of the work done. Both examinations were made by the same examiner in the same laboratory with the child rested and happy. The first examination was made after a comparatively long railroad journey. Baron fails the second time on the definitions in terms better than use, although this was done very well the first time. He also regresses on the knowledge of left and right parts of his body and misses the esthetic comparisons. He failed to draw a diamond when first seen but does even more poorly this time. He fails this second time to do the Foal and Mare puzzle, makes more errors on the Seguin formboard and is very irregular in the use of the pegboard, his speed on various rows of pegs varying from 16″to 32″. There is no definite relation between the increased time and fatigue.

It is far too soon to say that this boy has reached his mental limit and is showing a degenerative tendency. However, the history of anti-social reactions, inability to learn in school, the hereditary neural disturbances, together with the indications of abnormality found in studying the child himself are sufficient to justify a diagnosis of "not normal." Baron is probably showing the early and evolutionary stages of a degenerative process which is affecting him earlier and more vitally than it did his forebears. Just what may happen we cannot as yet say. Prognosis must be deferred.

One other case out of this group needs individual consideration. Wharton has been under observation at intervals for two and a half years. He has all along tested very near the average for his age on both the Goddard Binet and, recently, the Stanford. He is small and always has been frail, taking every disease that appears in the neighborhood. He was slow in learning to walk and did not seem to have the strength to get around. He is of unknown parentage, although it is said his parents were of good families. He is an illegitimate child. From the time he was a tiny baby he has had a very good home. At the age of three he was reported as bright and lively but very untidy. This report is repeated again and again through his history. He is also said to masturbate, to tell lies, to be unreliable, listless, heedless, lazy, bright and getting along well in school, but dull and irresponsive at times. No punishment seems to affect him at all. However, the most persistent difficulty was the untidiness of personal habits, that is, the constant enuresis and frequent soiling of his clothes and bed.

This habit was broken twice for definite periods, once at the age of seven when he was tried in another home and again at the age of eight when he was taken away for several

months. The first time he was not at all better while he was away and he was treated very much less sympathetically than at his regular home. The change came upon his return to his regular home, he tried hard, seemed to appreciate what was done for him and was really clean for several months, then the old habits re-appeared. The second time he was away from home for five months and he gave no difficulty in any way during the time. Indeed, it seemed hard to believe that the reports made could be of the same child. When he was returned to his regular boarding home he was clean for eight months and then the old bad habits returned. Finally he became such a problem that he was admitted to Waverley for observation. From the first there was absolutely no symptom of any such untidiness, and yet there is no doubt of the accuracy of the earlier history. Nor has the habit returned since the child left Waverley, being placed in a new home where there could be no association with the earlier environment either mentally or actually. To the writer this history is the straight story of the persistence, in a rather neuropathic make-up, of a pathologically conditioned reflex. The initial incident cannot be traced. It may have been simply the over-emphasis laid upon his failure to form cleanly habits by the age of three, for there is no mention of this as a difficulty before that, although he had been in the same home since nine months of age. His slowness to learn this may have been due to his poor, sickly body. We cannot say. But there is no doubt but that a scolding woman, over-conscientious emphasizing of the child's fault, plus morbid self-consciousness of it may just have associated contrariwise, producing the bad and not the good habit. The conditioning of this might then gradually extend until the whole homesetting was associately involved. Change to an entirely different environment breaks down the habit which re-appears only after re-association with the old stimuli. This interpretation seems to be even more fully justified when we find that the child has always been cleanly in school and is so at home for a time, if very sharp punishment is used.

Wharton is a bright, lovable little boy, quaint in conversation, gossipy and preferring adult to child companions. He does well on all auxiliary tests, learns readily, adapts rather poorly, has good motor control, is rather over-tense, eager to do things, and gives no indications of lazy or dull spells. We feel that a new chance and careful training may do much to bring this boy back to an approximately normal childhood, although he is handicapped by a poor physique (merely frail, no actual physical abnormality) and a neuropathic instability. He is by no means psychopathic.

The other ten children of this group are surely feeble-minded. The I Q's by the Goddard Binet would not now be diagnostic on more than four of them if we used I Q 80 as a criterion. They would be diagnostic on seven if we use 90 as the diagnostic ratio. Five of the children now have an I Q of less than 76 on the Stanford and two others are less than 80. Yet, despite the high rating of the rest, corroborative data from other lines of observation and investigation make all who work with these children *know* that the whole ten are feeble-minded. Retardation to the point of Primer work in school, sinking to their level in an institution group of similar grade with no attempt at leadership in either games or mischief, inferiority on supplementary tests in the laboratory, all confirm the feeling of those who work with them that these are undoubtedly feeble-minded children.

The first psychological examination of these children does not show any distinctive distribution of tests done. Nine of the fifteen children are right up to grade with a basal year of seven, and no lapses below that age. Four have a basal year of six and the other two go back to five. Those who have a basal year of six all fail to draw a diamond but that is the only common failure.

The histories given in the ten cases, which are not reported individually, are fully as indicative, as those given above, of something wrong somewhere. Only one of the children was considered bright in school, while five were reported as definitely below grade. In two defect was noticed in early infancy, in the other eight at from four to six years of age. Three of them lie, five steal, seven masturbate and one attacks other children sexually. Four are cruel to children and two are cruel to animals to the extent of putting cats on hot stoves, killing chickens by throwing them to dogs to see them try to get away, etc. At least three of them are pyromaniacs, eight of them are passionate and have temper spells, seven of them are destructive. In several cases the parentage is unknown but the rest are weighed down by a history of alcoholism, immorality, a little insanity, general inferiority but not feeble-mindedness, and three of them are illegitimate.

The mere statement of these facts is enough to show that this group of children is far from an average or normal group of seven year olds. It is to be noted, first of all, that they are a group who were so much worse than other children with whom they associated that they were brought for clinical study. This does not interfere with the fact that they were all children who at one time tested "at age," with consequent intelligence quotients lying well within the at age range. The error comes in assuming "at age" to mean "normal." Testing at age is

a diagnostic phrase; it merely means that *on these tests* this child is able to do all anyone may expect of a child of his age. Testing normal may mean the same thing but we are too apt to interpret into that phrase the conclusion that the person who tests normal is a normal person, and then comes the more hazardous deduction, that he is going to keep on developing as a normal person.

RELATION OF MENTAL AGE TO ACTUAL AGE

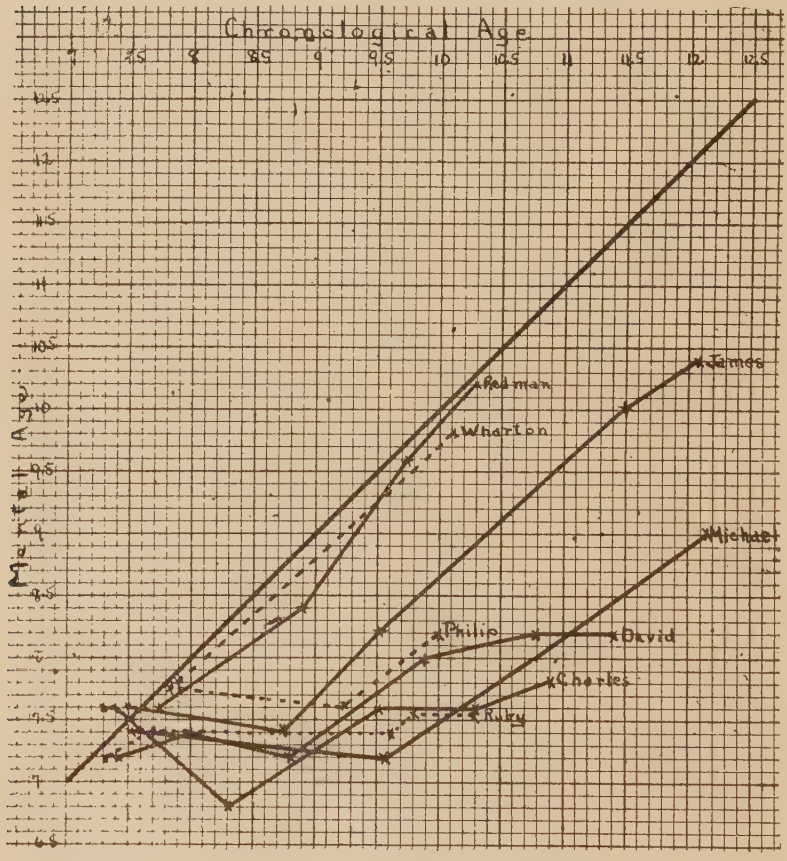

CHART I

The original test gave us a diagnosis of present mental level, pointed out just where the child was at that time; but making inferences regarding future growth is prognosis and

our tests have not been standardized in a manner that enables us to use them for that purpose. This one group of cases is enough to prove that.

It is also self-evident that I Q's do not remain constant. In the five cases studied recently enough to have Stanford ratings on several examinations the I Q's change both ways, up and down. Up seven points in seven months in our problem case, Daisy, down nine points in a month on Baron, up seventeen points in less than a year on James and down three to nine points in a year with the definitely feeble-minded children.

The curves on Chart I show the mental development of several of the children and may make the data already presented clearer. The progress of a theoretically average child who maintains an I Q of 100 is represented by the uncurving diagonal. The other curves are all those of children discussed in this article.

Nor are these children who test at age and then show a sudden lack of further development to be found at only one mental age. They may not be as frequent at other ages and this relative frequency itself raises a lot of interesting speculations as to the phylogenetic significance of such cases. Following are a few brief resumés which will illustrate the potentially feeble-minded as they appear at other levels.

Anne, 5 years 6 months old, mental age by the Goddard Binet 5.2, I Q 95, when first seen, is now 8 years 11 months old and tests 7.6, I Q 85. Her present Stanford rating is 6 years 8 months, I Q 75. This little girl began giving trouble when she was five years old. She would not mind at all. She is an illegitimate child whose mother died when she was born. The child was raised by her grandmother and was so nervous that her grandmother finally could not stand having her around. Even the parochial school refused to keep her after a brief trial. She is still very nervous, although not actually choreic, is quarrelsome, cannot get on with other children either in work or play. She is very defective in learning and in inhibition according to the conditioned reflexes. She is also poor in performance tests and she cannot learn in school. None of those who work with her question her feeblemindedness.

Karl is an unusually good example of the potential feeble-minded child, although he is not an uncomplicated case. When 9 years 10 months old he tested 10.4 on the Goddard Binet, I Q 106. At 10 years 5 months he tested 10.0, I Q 96, at 12 years 4 months he tested 11.0, I Q 87 and at 13 years exactly the same I Q being 85. One might suppose that some of his apparent retardation is due to the scale but he does no better

on the Stanford. At 12 years 4 months he scored 10 years 6 months with an I Q of 85, while at 13 years he scored only 10 years 8 months, I Q 82. In most ways Karl seems to have about reached his limit. He has always had the best possible kind of a home and the most loving of care from his adopted mother. He began when he was only two years old, with screaming spells which happened frequently and without cause. These spells gradually resolved themselves into fugues into which he would pass at any time and in which he would run away and be gone sometimes days at a time, indeed, until found. He stole, lied about what he did when running away, never seemed to remember any of the things that had actually happened, and gradually became impossible to handle because of the frequency of these spells and the worry they caused. He is the illegitimate child of a feeble-minded girl whose mother was probably an epileptic. The maternal uncle of Karl was undoubtedly very like him, with similar wandering spells, indeed, he was killed by a train when running away when ten years old. The father of Karl is a hydrocephalic, excessively alcoholic bartender. The man's father and mother were both alcoholic to the extreme and one of his brothers is " paralyzed." Karl does not run away now but he has equivalent attacks in which he cries, is stubborn, and uses profane language. He has evidently inherited all of the peculiarities of the two families for he is also slightly hydrocephalic. Karl has enough mentality probably to get along out in the world were it not for these complications of the actual inferiority; but with a feeble-minded background for a psychic epilepsy with its consequent instability he is a typical institutional case and despite his original grading by mental tests needs constant provision and supervision.

One more case will suffice to show the potential defective. Ralph tested 8.2 when he was 8 years 11 months old, I Q 92. When he was 10 years 2 months old he tested 8.6 years, I Q 84. He was also tested twice by the Stanford Binet, his mental age both times being 7 years 4 months, I Q's being 82 and 72 respectively. This boy is delinquent, has a mania for lighting matches and setting fires. He is also cruel to other children. There is no doubt but that he has already reached his mental limit. He is not a straight feeble-minded child, however, but shows such marked aberrational tendencies that we are justified in calling him a psychopathic defective.

This case illustrates also the change in Stanford I Q as well as in that obtained by the Goddard scale. The various scattered references to the Stanford fluctuation which have been made here and there through this article will have to suffice as evidence for the present. The scale is too new to

allow the presentation of prolonged case studies in terms of it at this time. Nor can we settle the relative frequency of such change. It does occur, however, and in all sorts of cases, on all parts of the scale. We have at present under observation as out-patients from the Waverley Clinic eight children who test at age by the Stanford but whom we feel to be feeble-minded. Only careful following of these cases for a couple of years will tell whether this feeling, based upon clinical experience, or a mental age, based upon averages, is right.

There are, of course, atypical children whose mental age improves at such a rate that they have constant I Q's. For instance,

Jane tested 5 years at the age of 6 years 4 months, I Q 79.
5.2 years at the age of 6 years 7 months, I Q 79.
7.4 years at the age of 9 years 4 months, I Q 79.

However, it is impossible to say that she will maintain the same I Q for even another year. Ernest illustrates this same stabilized I Q in an older, very feeble-minded child. He was examined when just 12, then when 14, and again when 16 years old. His various test scores were 7.2, 8.4, 9.6 years, the I Q remaining 60.

On the other hand, George, who was far more favorable, according to tests and I Q when first examined and who would impress any stranger as potentially better than Ernest develops as follows:

Mental age..... ...	8.2	9.2	9.2	9.4	9.2
Chron. Age	11–8	12–3	12–10	14–1	14–11
I Q	70	75	72	66	61

His present mental age by the Stanford is 9 years 1 month, I Q 61.

It does not seem worth while to take up separately the findings on the Point Scale coefficient. It fluctuates in similar fashion to the other ratios, and Yerkes acknowledges this. Defective children frequently have C. I. A's. which are far above eighty and which sometimes reach a hundred in a feeble-minded child of the verbalist type. We have two groups of coefficients on the fifteen children reported in detail above. The coefficients for the five who are still unprognosed are as follows:

1917.....	—	87	75	91	94
1918.....	95	91	92	86	87

The coefficients for the ten who are now definitely classified feeble-minded are:

1917....	89	68	87	67	83	71	86	72	74	88
1918....	72	71	89	56	81	86	83	66	68	79

Another difficulty which is too little recognized comes when the mental age or the intelligence quotient is the basis of a differential diagnosis without sufficient supplementary evidence. Pearl is 19 years old and tests 6.2 by the Goddard and 5 years 4 months by the Stanford scale. She is a little slow reacting and shy but this does not interfere with her going through the tests in a fairly satisfactory manner. According to I Q she would undoubtedly be rated by an amateur as imbecilic. Indeed it was as such that she was committed to Waverley. A single conversation with her would be sufficient to assure any one at all acquainted with such cases that she was a dementia praecox. The quality of the things she did and said indicated remnants of a higher mental ability than even morons usually attain. Yet neither a mental age nor an I Q can tell us when we have feeble-mindedness or a case such as this.

There is one other type of child, known to the writer, who fluctuates unusually on mental age scales and consequently on any ratio system. A number of these cases have been at Waverley in the last couple of years coming usually as observation cases. The members of the group are very similar, though, and the description of one of our most extreme cases will give the clinical concept of them all.

Riggi came for observation when 13 years 4 months old. He seemed well-developed and nourished and was in good health. He had been under State care for nearly seven years as his father was alcoholic and had neglected the family until they were half starved. Riggi is the fifth of seven children, all getting along well except the next younger girl who is slow in school. About the age of ten Riggi began to give trouble. He was untruthful, masturbated, became very unclean in his habits, lied about things in his foster home, saying he was not fed well, etc. He was then placed in a new home and did well for about three months. Then again, he began "doing queer things." He planned to kill all of the people in the house, became bestial, tried every possible experiment with medicine and food, intermingling these experiments with scatological rites. He started fires eight times, tried to mutilate animals, tasted such things as arsenate of lead, Paris green, carbolic acid, bluing, benzoin, gunpowder. Took to pieces everything he could lay his hands on from the water-pipes to the phonograph and telephone. He tried to make the boarding woman's little boy eat a caustic pencil. He stole cream, eggs, and food of every sort, in such quantities that he could not have eaten it all. He killed two calves by abuse and poison. He also killed thirteen hens and he killed the cat by cutting his tail off and then poisoning him. He lapped the animal's blood from the

butcher knife with which he had cut it. He tried to kill the wee baby by putting carbolic acid into the nursing bottle. These details are only an abstract indicating the various directions of his activity.

When admitted to Waverley he tested 11.2 by the Goddard Binet with an I Q of 84. By the Stanford Binet (re-estimated from the Kuhlmann-Terman) he scored 11 years 6 months, I Q 86. He quieted down at once, showed no signs of any abnormality of interest, was rather dull, slow reacting, phlegmatic, kind and well-behaved. When 13 years 10 months old he seemed to brighten up, and upon re-examination he scored 12 years 5 months by the Stanford, I Q 89. This improvement continued. He showed great interest in reading, did well in all sorts of work, took leading parts in complicated entertainments and was generally liked and helpful. When 14 years 8 months old he was again examined and scored 14 years 7 months on the Stanford, I Q 99. This is evidently a definite mental change and could not be due to his having done tests he was not tried on before, for at each examination he was carried through every test, even at the superior adult level. The difference was marked in every detail of his work. He reacted promptly, concentrated on the task in hand, and gave answers rich in detail. He improved similarly on performance tests and changed on the Kent-Rosanoff association test from a low value, delayed type of response, with many individual responses, to reactions of a type which places him very near the norms for boys of his age.

At this time he was sent out again and placed carefully by the State visitor. He has now been out nine months and a report made just recently, by his visitor, says he is getting along well and has shown no aberrant traits in the whole time.

The history of this boy before he came under observation is an extreme one, but his behavior on mental tests is typical of a large number of cases. Some disturbing factor brings to a rather unstable, or psychopathic, personality a stress which it cannot stand. There may be as a result erratic behavior, merely a confusional state or a combination of the two. These reactions can usually be identified as exaggerated forms of tendencies present before the period of stress. A mental examination at the disturbed period may even throw the person into the feeble-minded group, so far as level and I Q are concerned. In some cases the situation may clear up in a few months, in others it may take a prolonged period of study before the better side of the person's ability shows itself. Quiet, regular living and wholesome food and work re-enforce the normal traits and subdue the others. Little by little, actual improvement occurs in work, in social reactions, and in

test results. The fallacy of settling such a case by one examination is apparent. Even a year's study is not enough to give prognosis. Whether Riggi and his temperamental brothers will, once recovered, stay normal-functioning or will later pass through other cycles of disturbance, whether these cycles will show themselves as actual insanity, whether the early delinquencies are manifestations of such insanity are questions which can be settled only by continued observation of the individuals themselves. A single mental age or an intelligence ratio is impotent.

Conclusions

Mental ratios as an expression of a person's intellectual ability compared with the average ability of others of his age are, in most instances, a device proposed as an aid in diagnosis.

They are diagnostic of mental status only when used in connection with the actual mental age, the actual chronological age, and evidence gathered from other fields of inquiry.

They have, on insufficient data, been taken as constant for the individual over his developmental period, to the age of 14 or 16.

Because of this assumption, they have been used prognostically in an entirely unwarranted fashion.

The I Q or C. I. A. of the individual feeble-minded child is sometimes not in the least a factor differentiating him from normal children of his age.

His I Q may decrease steadily through even the earlier years of childhood, it may stand still, it may even temporarily increase.

Even an I Q of 75 or 70 or 60 need not mean feeblemindedness. It may mean a dementia, either in the sense of insanity or of other deteriorating neural condition, as for instance a juvenile paresis.

Because of this neither an I Q nor a mental age per se can be taken as a basis for a differential diagnosis, save in most marked cases.

The situation is still farther complicated by the fact that children with comparatively low mental ratings sometimes show an unexpected mental resiliency and rebound towards average endowment in surprising fashion, making up most or all of their lost standing.

In consideration of these varying possibilities it seems only right to insist that a single I Q or the findings from a brief examination be used cautiously as a basis for anything more than a statement of present mental level, *unless* they are used correlatively with a complete survey of the child from the

standpoint of his social, moral, and educational behavior and his environmental, physical and hereditary handicaps.

There is something more significant than mere mental age or years of retardation, a something we seem to have missed in our numerically finished clinical studies. At two an idiot, an imbecile, a moron and a normal may all seem practically the same. Then the idiot drops out of the race, stays at that level. Somewhere, in the next four or five years the imbecile falls behind, but the moron may be even ten or eleven before he evidences any real deficiency on our present systems of tests, Yet the difference has been there all along. The moron was as feeble-minded, potentially, at the age of two, as at twelve. The normal child was as surely normal. There is an innate difference hard to describe but all who know defective and normal children often recognize this qualitative difference before any quantitative test has demonstrated its presence. It seems as though with some the evolutionary nisus has spent itself with the effort necessary to bring into being, with others there is no energy there to meet the demand for speech, with others concrete stimuli can evoke satisfactory responses but there is not enough motive power to meet the demand for response to the faint stimulations made by abstract ideas, theories, principles, etc. But the normal child is entirely different. He lives only as an incarnation of activity, he is activity, innate, flooding, spilling with every new stimulus, responding with growth to every new demand made upon him.

Because of this obvious difference we may hope for the time when even our test principles will have so embodied these same differences that test results will be more definitely and differentially diagnostic and prognostic. We may then hope to detect possibilities and inabilities in the earlier years of childhood and do more preventive, less corrective work. But even then let us hope that it will be the study of the individual and not the mathematical application of a statistical probability upon which will be based the humanity of treatment accorded him.

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THE RITES OF EDUCATION: PRIMITIVE AND ADVANCED

By Lieutenant Wilson D. Wallis, Camp Lee, Va.

The savage is so intent on being practical that he makes of himself one of the least practical of creatures. He is so intent on his own limited sphere of life and activities that he has no perspective from which to view his world and never understands his own life and his own activities. This does not decrease his confidence in his system of values which he embraces but rather enhances it; for confidence is destroyed only when the light of a larger world has penetrated and cast its glow over things new as well as things old, leaving their comparative magnitude open to observation. To the extent that savagery has encased itself in its own activities, life, and ready-made formulas, it is safely insulated but woefully isolated. It will allow little to go from itself into the larger world and correspondingly little of this larger world will filter in to it.

There is this same disposition in civilized society. The barriers may be less, the insulation may be thinner, but it is there, encasing the nation in its thin or thick covering of self-confidence, prejudice, and arrogance. The difference is a difference of degree rather than of kind.

The savage has worked out for himself what is, from his point of view, a thorough system of education. It leaves no nook nor cranny of his social, industrial, moral, and religious life unprovided for. This life has more ramifications, is richer in content, than the layman is prone to think; it takes a rare and assiduous civilized scholar to probe it and none, so far as I am aware, has ever professed mastery of its intricacies, though not a few have devoted themselves to this task.

A system of education which takes care of this life cannot, of course, be easily understood nor comprehensively outlined in a few paragraphs; suffice it to mention a few of the more important phases of savage education. Since our educational systems reflect similar methods, the question of comparative value is involved. Either savage education is well advanced or our own is still primitive.

The savage, to be sure, does not reflect upon many of the processes of education which he employs, but this impairs

neither their actuality nor their effectiveness. Whether he reflects upon his distinctions or not, he recognizes clearly two classes: things that are and things that ought to be. The process of welding things that are into things that ought to be is education, whether there is or is not a socially sanctioned way of doing this.

The end is, of course, the important thing. But since the savage must devote most of his attention to the means in order to make them effective, there is a tendency to view the means as all-important and to forget the object served. Hence method, procedure, becomes all-important and that to which they induce is forgotten. Thus the value of his educational procedures degenerates rapidly because the plastic means soon harden into certain procedures which he performs for their own sakes, and these procedures become fixed and inflexible.

Wherefore we find him performing a great many rites in whose automatic efficacy he profoundly believes. Their purposiveness may be evident to a more discerning wisdom but the teleogy is evanescent and probably no longer clear to him. His life becomes cataloged into a certain number of stages and transitions; he is *this,* a certain procedure transforms him into *that;* another procedure into something else. Today the Australian lad is a boy living with the women and participating in their restricted pursuits; tomorrow he is initiated into the tribe, becomes a man, puts away childish things, enters upon a new sphere of activity and is under new influences. As often happens in savage life there is an abrupt transition from one status to another.

Not only is there a change in the outer environment, there is a conviction that an inner transformation has, pari passu, taken place. The lad becomes a man, the old self dies, a new one is born. The evidences of this transformation are, a new name, the right to participate in totemic, religious or ceremonial rites, to paint the face, to wear distinctive head-dress or body dress, circumcision, piercing the nose, or other adornment or mutilation. These are the signs physical and social of a step upward in the hierarchy.

The method is effective. The youth feels suddenly exalted, others accept his exaltation as a fact, and all goes smoothly, How could it fail to go smoothly? Is it not, after all, but a game devised by the tribe, and must not all go well so long as they follow the rules laid down by themselves?

But, one may ask, is not the progression a real progression, the advance in the hierarchy a real advance? Assuredly it is. But assuredly it is an advance only because it is conforming to the rules of a game of their own devising. What nobility there is in the pursuit, in the devising of such a game and

such rules, is another matter. Whether the distinctions have any value except as regards the rules of the game is still another matter, and, in estimating their higher social and educative worth, the only one that counts.

Our arbitrary and senseless academic distinctions, which a keener sense of humor will some day relegate to antiquity, but to an antiquity which is, alas! our future, pervades our entire system of education, whether organized or unorganized. We leap from one stage to another, or rather, are carried from one to another by certain rites designed to bridge the abrupt transition. These *rites des passages,* or rites of transition, constitute our organized educational procedures, designed, in many cases, to carry the student 'from precipice to precipice.'

"To avoid harsh distinctions, to bridge over abrupt transitions, is always a mark of advancing civilization; but the savage, in his ignorance and fear, lamentably over-stresses distinctions and transitions." (Miss Jane Harrison, Ancient Art and Ritual, 106). But this distinction between savagery and civilization is only relatively true. We still flaunt degrees and diplomas and vari-colored gowns, in which physical and social evidences the academic world takes as keen delight as savagery in its new titles and gew-gaws acquired after passing through the prescribed rites and meriting the promised rewards. We still have our high-sounding titles and body-and head-dress to set us off from the larger vulgar world. We have made the rules of our academic game, we abide by them, and we rise according to them very much as the savage plays his game and rises in his own estimation and in the estimation of his competing fellows—indeed, very much as the savage plays and rises. Back to the life of Nature's folk, exhorted Rousseau; well we are still back to this life in many respects. Give me education, said Leibnitz, and I will change the face of Europe in a century. Europe has had its century of education but the deeper lines of her visage have not been materially altered. It is still true that to find the savage you have only to scratch the civilized man, for the whole of civilization lies like a thin gossamer over the older strain of a primitive savagery; the procedures of civilized education are but attenuated refinements of savage education.

That these *rites des passages* which have come to pervade our educational system have a certain pedagogical value is not to be doubted. They subject the candidate to a certain social or mob psychology which argues well for the solidarity of the group; they rub off the edges of individual variations and reduce all to a type; they give us a uniform product, a consciousness of kind; and all this makes for social solidarity. But perhaps for the kind of solidarity that a flock of sheep

exhibits. It tends to induce a 'sheep-through-the-gapiness' type of mind. It finds no place for Nietzsche's motto that 'one requiteth a teacher badly if one remain merely a scholar.' (Thus Spake Zarathustra.)

The pedagogue may point out that these rites furnish strong psychological stimulus. They bring about, often, a heightened attention and interest, though they as frequently induce, by their mechanical monotony, a lack of attention and of interest. If the shift is sudden and severe the new angle on interests and on scholastic career may rouse a dormant mental quality or reinvigorate an old one. This furnishes some justification for the method.

None would wish to deprive educational methods of these advantages or of any other advantages. It must jealously cherish all of them. Perhaps, however, it can add to its goodly store others which are now not commonly within its ken. It need not subordinate result to method just because method is important. Method is not important except as it leads actually to some result. It need not act as if the part is larger than the whole, as if life circled about education systems and existed for their sakes. These hypotheses contrary to fact are not only ludicrous but sadly destructive of the ends for which they exist. The method must receive its cues from this larger world of life and be guided accordingly. Any hard and fast method is self-condemned; change and plasticity is the essence of life, and change and plasticity is the essence of any system that fits life.

A sense of the larger issues involved is, therefore, part of any method of education. It is, indeed, the more important part of it; not subservient to methods but rather directing them. Here, if anywhere, in attaining a knowlege of what we are about as well as in finding out what is about us, is salvation to be found. But no hard and fast method will ever discover it. In any system of education men are more important than methods.

Yet if the reader will look again at the preceding paragraphs he will find that, in spite of our boasted progress, wherever the word 'savage' has been written the word 'civilized' might be used with almost complete propriety.

THE NEW SCHOOLS IN EUROPE[1]

By A. Ferrière, Blonay sur Vevey, Switzerland

The type of school described in this paper is the outcome of an urgent need. Representing as these schools do a return to a more natural and more beautiful life in fuller harmony with the legitimate needs of childhood, and a more complete preparation for life, they are incontestably in the direct line of progress as indicated by the great prophets of education.

Experience shows that satisfying the legitimate needs of mind and body, i. e. returning to nature, constitutes a more direct and effective preparation for contemporary life than that offered by the ordinary educational methods. After all, what is asked of young people just entering upon life? Knowledge no doubt, but still more experience; or failing experience, an intelligence sufficiently lively and flexible to adapt itself to the conditions of a particular task. Strength, integrity, an enterprising spirit, and endurance at work—these the New Schools intend to give to the children entrusted to them.

Character is not conferred upon a child, he is permitted to acquire it; similarly, we do not force ideas into a child's mind, we enable him to formulate them by his own efforts. Each New School is an educative medium, or rather several educative mediums combined in one, a physical, an intellectual, and a moral medium in which the child is provided with what he needs for his development by self-activity. In each of these fields the New School presents distinctive characteristics. It is situated in the open country, far from cities. From air, light, verdure, fields, woods, flowers, perfumes, and breezes, emanate health, strength, and the joy of living. It has been maintained that the child should be accustomed quite young to the life of cities where he will perhaps have to work when he is grown up. This is a mistake. If he has lived as a child the life *par excellence* of childhood, that of the fields and woods and of abundant nature, the adult will adapt himself more easily to a life even if unpleasing, forced upon him by circumstances or duty. The essential thing at the dawn of life is to learn to master oneself and to enrich oneself unceasingly

[1] See also T. R. Croswell: L'école des Roches: a school of the twentieth century. *Ped. Sem.*, Dec., 1900, v. 7, p. 479-91.

with strength, energy and new knowledge. Now, no environment lends itself so completely as the open country to the practice of this art of living.

Nevertheless the educator must be present to guard against physical exercise taking an exaggerated place. In the order of functions, the mind occupies the highest place and it is in its service that bodily energy must be acquired or conserved.

There are two primordial conditions without which no intellectual work is fruitful. One is external to the child, the other lies within him. The external condition is well recognized by all teachers but seldom realized: the young mind must be made acquainted with concrete facts, not with abstract ideas. We attempt this but inadequately, and demand at once that the child rise to abstractions. The pupil, even when he retains these abstract ideas, loses contact with the facts, forgets them, and becomes like so many others, a perfect ignoramus or a mere book worm. The child must in some sort be steeped in facts. He must not laboriously deduce a law from ten observed facts; but of the hundred or thousand facts observed, the law must arise of itself in his mind. Psychology shows moreover that up to about the age of twelve years the memory for concrete things is at its best. Never again in his life does man enjoy an equal power of assimilating the details of concrete experience. On the other hand, from 15 or 16 years of age the youth feels the need of relating facts, of comparing them, of abstracting, of establishing relations of cause to effect, not only as between one fact and another but in their universal interrelations.

These needs, differing according to age, must be satisfied. We must not, as is generally done today, impose on the child reasonings to which he is as yet indifferent. We must do away with the abuse of grammatical exercises and classifications, with all the hollow verbiage the usefulness of which he does not understand. We must not impose on the youth superhuman efforts of pure memorization, as is undeniably the case today in preparing for examinations. In vain do we say to the students: Work for your future and not for the examinations; assimilate your knowledge and do not be content merely with memorizing. The requirements are there, and their demands are such that one must be exceptionally gifted not to have to spend all one's available strength on the simple mechanical work of acquisition.

If on the contrary, the child is allowed sufficient contact with the facts, connecting them logically in just so far as he himself needs, and if the adolescent is made to think over the facts henceforth in his possession—the structure of knowledge thus acquired will be so firm, so well established, and

its elements so intimately united that pure erudition, if necessary for this examination or that profession, will find a solid foundation. Experience proves it.

Moreover the satisfaction of genuine needs brings about a deeper and still more immediate result; lively interest. This is the inward condition of productive intellectual work. But how to arouse interest?—By satisfying the intellectual needs of the child. And how to recognize these needs?—By conforming to the psychological laws of intellectual evolution, and above all by observing the manifestations of such needs in the children before us. Hence the necessity for all teachers to understand thoroughly child psychology.

The intellectual setting of the New School will thus possess the following characteristics: it will tend to arouse the interest of young people for the subjects treated in their lessons, it will offer abundant means of self-instruction in the form of concrete objects, pictures, laboratory experiments and the observation of various phenomena in nature.

Intellectual education in the New Schools may be characterized in a word as a process which does not impose knowledge from without, but rather places the child in a position to discover it or, better, to create it within himself. Moral education is based upon the same principle. Instead of imposing artificial rules of conduct which run the risk of having no influence upon him or even of becoming distasteful because they hamper him and because he does not understand their significance for life, the new education expects the child to conform his outer life to an inward rule of his own volition because he has thoughtfully judged it good. In other words, our education will not impose from without a moral code upon the child. He is expected rather as a result of his experience to perceive the need for order and for good and to express this freely in activity that conforms to the general good.

Physical Education.—Dr. Lietz, the founder of the German New Schools gave them the name *Land-Erziehungs-Heime* (Home for education in the country), intending thus to indicate that the natural dwelling place of the child is the country. In these schools one finds usually a complete farm equipment, cows, horses, chickens, rabbits, bees; and there is space, plenty of space. What more is needed to make a child happy?

Life is simple, no luxury or artificial comfort. The pupils enjoy as much as possible open air. Everything that can be done out of doors is done in the open: lessons, evening lectures, and meals take place out of doors whenever the weather permits.

Each pupil spends one or two hours a day in agriculture or shop work. Manual labor makes for steady nerves and self-control; and when regular and not excessively fatiguing, it is a source of endurance and strength.

Gardening for the little ones; agriculture for the older ones; and, for all, the raising of animals of various kinds are appropriate and enjoyable activities. They are useful for the development of the body, they teach the children a thousand useful and interesting things, and develop in them practicability; moreover, while devoting themselves to these labors, the children feel that they are working for the welfare of their little community.

Wood work also is treated not as a play but as a serious branch of the school programme. As carpenters and joiners, the pupils produce useful things. They learn to make bookshelves, tables, sheds for bicycles, etc. Everything the child does must have a useful purpose, otherwise his work does not interest him. The advantages of woodwork are numerous; besides the training of the eye and the gain in skill, there is training in patience, perseverance, and self-mastery. These are the abilities and qualities which life will demand of the young man. The psycho-physiologists have shown that it is through muscular control that we learn self-control. It is confidence in one's manual strength and dexterity that engenders self-confidence for the great tasks of life.

The child needs to play. Games are as natural to him as song to the bird. They are the expression of the awakening of the body and mind and become a source of experience and a preparation for life. The child must therefore be able to play freely. But besides individual games, the child must enjoy team games. Foot-ball, particularly Rugby foot-ball, which brings every limb into action is an excellent training in courage, discipline, cooperation, and solidarity.

I do not know purer joy than winter sports. Coasting, skating, ski-ing produce an open air ecstasy difficult to explain. Is it the stinging cold, the breathless speed, the demand upon your skill, the threatening danger—danger no more serious than being engulfed in soft snow—is it all these allurements together? I know not. The fact remains that all these sports, particularly ski-ing, exercise an irresistible attraction upon those who have tried them.

But walking is in all seasons, the chief sport of the New Schools. At least every fortnight and sometimes oftener, teachers and pupils take an excursion together to a mountain top, or to some spot interesting for its beauty or its historical associations.

The pupils visit also workshops, factories, and museums of

the neighboring towns. Short holidays of two or three days allow teachers and pupils to undertake longer excursions. At Easter or in July, Dr. Lietz usually organizes long cycling tours through Italy, France, Germany, England, and even to more distant lands. Where could a more interesting experience, a more effective lesson in cooperation be had than the one provided by these fairy-like trips where one sleeps under a tent and does one's own cooking?

The New School pays a great deal of attention to hygiene. A health record of each pupil is kept. He is weighed and measured at the beginning and end of each school term and is periodically examined by a physician. Physician and educator must cooperate, for most physical disturbances arise in the organism, or at least react upon it.

To sum up: if the New Schools seek the healthy development of the body, it is for the welfare of the mind. Both in physical work and in sports, the New Schools avoid all excesses, but they expect much in the way of health and especially of character building from these activities when patiently and persistently carried on.

Intellectual Education.—Let us observe first that the distinction between intellectual education and instruction, all important as it is, is often disregarded. To educate is to form the mind; to instruct is to furnish it. Is it not better to be able to use intelligently the knowledge one has acquired, even though it should be slight, than to be erudite and ineffective? As the primary object of the New Schools is to form men with clear understanding and liberated reason, they teach perhaps fewer things, but those taught are better coordinated than in most educational institutions.

It has been claimed that the pupils of the New Schools are less successful than those of the state and other ordinary schools at the examinations for degrees and official positions. That is a legend that must be destroyed. Every year the facts prove on the contrary, that pupils normally gifted and entirely educated in the New Schools usually take their maturity examinations or the baccalaureate brilliantly and astonish the examiners by their self-confidence, their presence of mind, and the thoroughness of their knowledge. Their superiority becomes only the more marked as they continue their studies at the university or take up their life work.

Should secondary education be professional or humanitarian? Both views have their convinced champions. The New School occupies an intermediary position. In its opinion either one of those tendencies, exclusively followed, would yield incomplete results. For that reason it imposes, like some American schools, a substantial nucleus of required subjects

(native and foreign languages, history, geography, natural sciences, and mathematics).

Teaching in groups has many advantages. It enlivens, awakens the spirit of emulation, and encourages imitation. But it suffers from the great disadvantage of meeting fully the need of a small number only—of those of average ability. To overcome this disadvantage, the New School has two means at its disposal. One of them is the system of "movable classes," chiefly used for foreign languages and mathematics. In these classes the pupils are grouped according to their ability and not according to their age or the class to which they belong in other branches. This method of grouping is all the more important because the method used in mathematics and foreign languages is cumulative, which means that the child can understand what follows only in so far as he has assimilated what precedes. The other means is the "individual program." Each pupil has his own schedule, adapted to his needs. The advantages of these simple reforms are invaluable for the individual development of the pupils.

Continuous work is the only productive work. The scattering of the child's attention over six or seven subjects a day, each taken up for three quarters of an hour, is a fatal invention of the old type of school. Doubtless the child needs variety; he must by turns listen, act, draw, write, memorize. He must consider the same subject in a thousand different and attractive aspects. But to compel him, as is done now a days, to touch upon a number of totally different subjects in the space of a few hours, can be but a detrimental intellectual gymnastic. In many cases he needs half an hour of slightly productive work before he can begin to concentrate his attention fully upon the subject in hand. If the bell rings when he has just warmed up to it, he spends his time warming up for a lesson never continued. In the New Schools an attempt has been made to avoid the disadvantage of this constant oscillation of attention. The regulation number of hours for the year is kept up, but for several weeks the pupil studies a given subject intensively. A livelier interest, less fatigue, quicker and more lasting results are the outcome of this greater concentration.

To these reforms of schedule the New Schools add reforms of methods. In this respect they do not differ from those other schools that have broken with the old routine. In the teaching of foreign languages, for instance, the New Schools use the "direct method" which begins with the use of the spoken language, and postpones the theoretical study until after much practice. In science, the concrete facts and the pupil's experiences are taken as a basis or starting point for

the deduction of abstract laws. In geography, the study of climate and products leads by logical connections to that of industries and of the racial characteristics of the inhabitants. In history, we are no longer satisfied with the memorizing of facts, names, and dates, without any logical connection. We try rather to determine the social effects of great events; we trace throughout the multiplicity of concrete facts the psychology of men, nations, and epochs. All these are without a doubt new methods, but they are not peculiar to the New Schools. The same remark can be made about the tendency to coordinate subjects, to connect, for instance, on the one hand history with geography, and on the other general history with the history of literature and of art.

It would be superfluous to give here detailed plans of study of the New Schools. They vary from country to country according to needs and interests. Better limit ourselves to a statement of general principles and practice. Put the child in contact with facts and awaken his interests. The psychology of childhood shows that nothing interests the child so much as his own activity. He finds interest in what he does or sees in the measure in which it can be of use to him. In other respects, the child is interested primarily in what affects him, and secondly in what concerns other children. To adults, he is more or less indifferent, unless they love him, care for him, and share his interests. Let the child be active. Keep him busy with work, the utility of which he realizes. In every possible instance, let him be put before the objects themselves or reproduction of them. Let him draw for himself, whenever possible, whatever he is to study, and let the teacher never weary of drawing before his pupil.[2]

There is no more fatal psychological error than the belief that the child must learn to apply himself to a painful task, meaningless to him, in order that he may learn to master himself. Effort for effort's sake, even if an ideal, can be appreciated by the adult only. It is no less than the matured fruit of a many-sided life, long accustomed to self-sacrifice. Moreover, one cannot, though it is often believed, "form the habit of effort." To be able to put forth effort in a given field, does not necessarily mean ability to do likewise in another. The fruitful effort is expressed in a habit already acquired, or sets in operation energies already in existence. The effort itself creates neither habit nor energy. It is in proportion as

[2] See in this connection our study, *Biogenetik und Arbeitsschule; ein Program zur Ausgestaltung der Volks-Schule.* Beiträge zur-Kinderforschung und Heilerziehung, Heft 101, Beyer und Söhne. Langensalza, 1912.

the child's interest is aroused that his latent energies become manifest, and that new habits become established.

What avail the most improved school methods if a pupil does not learn to learn by himself? "Learn how to learn," is a precept too rarely in the mind of the teacher. In the New Schools the pupils are urged to work independently, but first they are prepared for it. The pupils that have reached the age of twelve must complete by themselves work prepared in class. Later on, instead of requiring of them only brief tasks to be performed from day to day, as is usual until the age of eighteen, longer pieces of work requiring researches in special books, are assigned. Today, a real man of science is not one who, like a living encyclopedia, remembers everything he learns. Much more is he one who, knowing at every moment where to find the information he needs, develops ideas, contributes to scientific knowledge, and exercises a fruitful activity within the limits of his profession.

Moral Education.—If it be true that education is the development of each child's potentialities for good, it is easy to deduce from that formula most of the methods which may be applied to moral education. But before speaking of methods, we must agree on the goal to be reached; this goal is indicated in our definition of education. It is neither the free expansion of all the child's tendencies, nor the forced adaptation of his nature to an external and arbitrary ideal derived from a preconceived idea of what constitutes human perfection. When we speak of training young people to become well rounded human beings, we seek no more than to lead them to concentrate their efforts upon the development of their innate tendencies, so that they may become men with true hearts and strong wills.

The most striking characteristic of the New Schools is the great freedom allowed the pupils. Their education is truly one through liberty for liberty. But by liberty we do not understand the absence of limitations imposed upon the will; we mean on the contrary the liberation of what is best in the individual, the domination of the higher over the lower tendencies of his being. That liberty cannot be conferred, it must be won. He who from childhood has felt responsibility to none but himself and duty; who at his own risks has learned to estimate the consequences of his faults and has tested the joy of victory; who being loved, has loved in his turn, and has found the opportunity to give something of his time and his heart to those with whom he lives in daily voluntary self-sacrifices—such an one. when in the grip of life, is not likely to be snatched away in the whirlwind of cheap pleasures.

The objection will perhaps be made that the child is not ready for a life of freedom. I answer that if the child were a mature person there would be no need for education. The authority of the teacher and the obedience of the child must be the points of departure of moral education. But the great mistake of present education is to continue too long education by authority. The too exclusive desire of guarding the child from all false steps deprives him of experience and thus of one of the most essential elements of education: the experience of good and evil. Present day education *imposes* habits upon the child and omits to have him *form* habits. And the youth, not knowing why the good is good and the evil evil, or knowing it only in theory, is scarcely equipped to meet the vicissitudes of life. The child must learn to obey; but besides giving orders, the far-seeing educator will early give advice, which the child may accept or reject.

The physical environment has an influence on social life and thus affects the moral education of the child. By physical environment I mean what Ellen Key calls a "beautiful setting." We all know how great is the influence of environment. How much easier it is to be good in calm, well ordered, and beautiful surroundings, than in an untidy place where whatever meets the eye, is unpleasant and repulsive. I have already spoken of the influence of the country, fields, woods, flowers; of the distant restful horizons; of silence and light. The cottages of the New Schools are pleasant and comfortable homes; in every room engravings and pictures, expressing in the language of art noble ideas, establish in the child, without his being aware of it, a taste for the good and the beautiful.

In this connection the admirable influence of music and in particular of chorus singing, must be mentioned. No other kind of work, not even the active cooperation of the fields, with its common toils and joys, awakens to the same degree the feeling of solidarity. In chorus singing we feel ourselves part of a whole. We are carried along by the whole. A similar feeling comes to the member of an orchestra. Every New School has a pupils' orchestra.

It should be remarked, however, that the influence of the physical environment, is felt only when it serves as a setting to a well organized social *milieu*. The child is even more sensitive to the moral influence of his comrades than to that of his teachers. The school spirit is either a great lever or a great obstacle, compared with which isolated punishments are of little avail. A right public spirit, like good individual habits, is the product of work, order, and discipline. To establish that discipline upon rules accepted by the pupils themselves

is to have order on a safe foundation and to assure the regular work of the little school-republic.

Just as in larger states, the citizens have their rights and duties, so the young citizens of the New Schools have theirs. The many functions created for the good of the community by a rational division of labor are entrusted to those who are the most worthy of them. Each one according to his ability has a share in the preservation and progress of the miniature society of which he is a member. Not only are the pupils responsible for certain farm work and the care of animals, but the material and moral order of the house is intrusted to them. Those who give proof of faithfulness and good citizenship are appointed to positions involving extended social responsibilities. The "prefects" have, within indicated limits, the duty of calling their comrades to order and sometimes even the right of punishment. The system, applied in every New School gives excellent results. The citizens of the little school-republic prefer to be called to order by one of their comrades than by one of the teachers, and those elected to office gain a seriousness and self-possession that no other method of education could give them.

The relations between teachers and pupils are, in class as out of it, those of friendship between older and younger persons. Punishments must assume an impersonal and impartial character. If the master or the prefect is merely the executor of a law accepted by all concerned, if he acts without anger and with affection as one charged with a social duty entrusted to him by the community, if moreover he is tactful with the transgressor and immediately undertakes with him the reform which will prevent a recurrence of the trouble, the child, far from being offended, will rather esteem the more his master or his schoolfellow.

In the regulation of the child's conduct, reward should outweigh punishment, joy surpass pain. Annoyance, remorse, and sadness which decrease energy are rarely effective. Emulation is an excellent incentive to work and moral progress. To imitate others, to do as well and, if possible, better than they, are tendencies innate in every child. Consequently he should have the opportunity of comparing his work with that of his comrades; but still more frequently he should be called upon to compare his present achievement with his past performance. The realization of one's own progress is one of the liveliest kinds of encouragement. The feeling of progress achieved is both worthier and more effective than the feeling of rivalry.

The ideal goal of moral education is to make the child self-governing, free, and worthy of his freedom.

THE MENTAL DEVELOPMENT OF CHILDREN*

By G. W. A. Luckey

The nature of this meeting, the commemoration of the twenty-fifth anniversary of the national child study organization, throws one into a reminiscent mood. The coming into my home of a daughter in 1890 and of a son in 1891 turned my attention for the first time to real child study.

The following year I received my first baptism in the scientific study of children at Stanford University under the direction of the young but virile prince in that field, Professor Earl Barnes. In 1894, at Clark University, I came in touch with that living master of research in genetic psychology, the father of child study in America, the lover of truth, the children's friend whom we honor today, our own G. Stanley Hall.

Among the early prominent leaders in this new field were: Preyer, Tiedemann, Sigismund, Kussmaul, Genzmer in Germany; Darwin, Sully, Pollock, Warner in England; Taine, Perez, Eggert, Binet, Compayre in France; Hall, Dewey, Baldwin, Barnes, Miss Shinn, Mrs. Hogan in America; not to mention others whose excellent works in the early eighties and nineties did much to steady the movement. One can scarcely keep back the thought 'that if our efforts had only been stronger and our intelligence keener we might have prevented, by working together, this cruel war with all its human tragedies. Humanity is the same the world over. To know and control thyself, or, in other words, to discover God's laws and obey them, is the essence of all truth.'

Like every new movement, child study presented much of dross. Professional reputations were made and lost in a day. It was difficult to select the true from the false. Discouragements came thick and fast. The pseudo-expert who had entered the field for quick returns, left in disgust. The subject was so complex and results obtained often so meager, that many of our best students faltered. Even this organization in an unguarded moment added fuel to the criticism by changing the name of the department from Child Study to the less appropriate term Child Hygiene. But Child Study in its true sense has come to stay. Hosts of teachers are again returning

* An address given before the National Education Association, Pittsburgh, July, 1918.

to their first love, and by means of the opportunity now furnished them through graduate schools of education, they will be able to change their entire attitude and worth as teachers. There is to us all but one book, the book of nature with man its highest product and only interpreter. The true interpretation of this book gives all the truth and culture to be found in human life. Every individual has or may have the key which unlocks this sacred storehouse of all wisdom. The deeper and richer our study the more we become convinced that the essence of life and the laws of growth are the same in plant, animal, man. The study of one leads to a knowledge of all. Each is fashioned, through inheritance, to a special mould from which it cannot deviate except in the slightest degree, and then only on the juxtaposition of the greatest forces working in harmony. The common elements in all life are so numerous and so convincing that only the ignorant or mentally perverse need fail to see the relation and catch the spirit of the unity of life.

From the lowest to the highest forms of life this unity and conditioning of one by means of the other leads to faith in the plan and reverence for the truth that shall make us free. Under other circumstances I should like to call your attention to some of the beauties of the law of evolution, as manifested in the lower forms of life, indicating the value of construction and increase of life to destruction and loss of life, but another problem awaits me.

Man begins the journey of life as the plant or other animals, with a single cell. Through growth and cell-division the change is miraculously rapid at first increasing over nine-hundred-million fold during the first nine months and then increasingly slower, or about twenty fold more in the next twenty or twenty-five years. By adult life the single cell of the beginning has multiplied to represent more rather than less than four-hundred-billion cells clustered into groups and differentiated into organisms each with its special function and work to perform. Any disturbance of a single organ may be sufficient to throw the whole machinery out of gear. To illustrate, the thyroid gland, the function of which is not yet well understood, seems to secrete a food essential to higher brain growth and functioning, and also to act favorably as a remover of the toxic products of metabolism of the higher nervous system. Hence any pathological condition of the thyroid gland, as in goiter, myxedema, cretinism, is apt to be accompanied with severe mental disturbance, if not a complete nervous breakdown and feeble-mindedness. It is the clearer knowledge of this conditioning relation between the parts and functionings of the body that is bringing clearer to conscious-

ness the vital need of the psychological clinic to the public school system. If we surround the child with a suitable environment, remove as far as possible the evil effects of parental mistakes, feed each organism—physical and psychical—when hungered and nascent, teach the individual to direct and control the lower processes of thought and action by means of the higher, nature will do the rest and we shall all be proud of the product. The living organism must fill the mould before it can change or break it; that is, all progress of civilization takes place at the top.

The individual of today represents the accumulated experiences of countless generations. At the bottom of the push for greater and better life is the will to live. It is found in all animal existence, and causes the struggle that makes for civilization. Through it the one-celled animal adds sustaining elements to all life above it. Nature's laws are eternal and cannot be broken or set aside without injury to the whole fabric. To live and act in harmony with these laws means the fulfillment of God's plan and the establishment of the greatest good and happiness to man.

Every cell or organism, whether acting alone or in group, manifests this particular individual will to live; when acting in group it takes on a new function without surrendering the old, i.e., the will to live as a member of the special group. This is the essence of all later development, whether physical or psychical, and probably represents the biological root of individualism and socialism, a dualism in all that cannot be changed without the destruction of life itself.

But passing from the early beginnings to the twentieth century man, he is, as is well known, the embodiment of all that has gone before. To every individual, through growth and development, is furnished the opportunity to pass rapidly through the conditioning experiences of all the past, and then add his bit of truth at the top for the sustaining happiness of coming generations.

Because of the rich inheritance that falls to the lot of every individual and the binding effect of the inner life upon growth and development, intellectual freedom becomes a matter of necessity for all, or their failure to advance is ours, not theirs. In this growth and living over the history of the past the individual does so on many different levels. There are three in particular, found in childhood and again repeated in adolescence, to which I desire to call your attention. From birth to twenty or possibly twenty-five the individual passes through two important life-cycles of growth each containing three distinct stages or levels of growth. The first, from birth to two or possibly three, is the emotional level when the feelings are

dominant. The child is now a dermal animal. The epithelial tissue which includes not only the covering of the body but also the alimentary canal, the lungs, nervous system, etc., is making its greatest growth, and since it contains all the sensitive end-organs, it is easy to see why the feelings are now storing up a rich harvest for future use.

The second, from three to seven or eight, is the volitional level when will is dominant. The child is now a motor animal. The muscles, especially the large fundamental muscles, are passing through their most rapid growth, and require the exercise that makes of the child a dramatic or doing animal.

The third, from eight to twelve or fourteen, is the intellectual level when intelligence begins to get control and is dominant. The child is now a discriminating animal. The finer muscles are developing and demanding exercise or use. Skill of movement now takes the place of the awkwardness of former years and lays the foundation of the formal side of education essential in later years.

As is well known, all true education develops from within and cannot be hurried nor aided by dictation nor force from without. If education is the change wrought in an organ or organism through individual experience, one can see how by following in the path of the biological steps here shown and conforming our teaching to the inevitable laws of nature, we could soon create a new civilization.

True teaching consists in discovering the natural laws of human development and bringing the mental food to the child in the form and at the time in which it is needed and can be utilized. This first cycle of individual growth is known as childhood. It is selfish, individualistic, and based on physical hunger, food-getting and self-preservation.

The second cycle is known as the cycle of adolescence. It repeats in a similar order the same three levels or stages of development. A new birth occurs, the entire physical growth begins anew. The motive is sex hunger, procreation, and parental instincts. Socialism and altruism become necessary concomitants of future existence and tend to increase the individual love of life and interest in nature.

The difference in the rate of development now between the boy and girl makes it necessary in our scheme to separate them. Hence I shall proceed with the boy in mind. From fourteen to sixteen the dominant growth changes seem to be dermal affecting the epithelial tissue and producing innumerable new feelings and emotional desires. This is known as the adolescence period *par excellence* in gathering, testing, trying-out, and storing away new experiences, laying the foundation for later versatility and strength.

From sixteen to eighteen (the definiteness of these statements should not indicate that there are not many overlappings) is the second period of most rapid growth of the large fundamental muscles when the will and the desire to do are again dominant. This is the time for general training and education. The boy now delights in rivalry and feats of strength. If he is not handled right he may leave school before his time to enter the dynamic world where he can do and dare. Woe to the insipid teacher in this stage and the next; later generations must suffer for the want of a man. Today, as never before, the world needs men, truly educated men; men of clear vision and consecrated wills; men who believe in God and love His children; men who will not hesitate nor falter where truth points the way.

From eighteen to twenty or twenty-five is the period of the second rapid development of the finer or accessory muscles. This is the period *par excellence* for specialization in education, the selecting of a profession or trade and perfecting ability and worth in it; seeing, appreciating, and promulgating the finer things of life. The individual is sure to appreciate the natural order of human development and have many inclinations to follow it in the direction of a higher life and a better civilization. If he does not improve upon his inheritance it is because of a faulty environment or bad teaching and not because that God so willed it.

If you have followed me thus far I shall ask you to go with me now over another step which to my mind is the most important of all. I have been considering human development ontogenetically; I desire now to consider it phylogenetically. As the individual passes through his ontogeny by means of special steps or levels, so he lives over and develops his racial history on definite stratas or special levels, three of which must have held his forbears fixed for ages. If we now take a sweeping view of racial history and experience, we note that besides the dualism resulting from the interaction of the physical and psychical, there is the well-known trinity of the psyche-emotion, volition, intelligence. Now if we consider the larger period of human development when the feelings and emotions are dominant, and when body growth is the principal function, I think we can safely say it covers the first twenty to twenty-five years of life. Barring the stress and strain and the many struggles of altruism that appear, it is the period of selfish individualism, the perfecting of the body and of being stimulated through the fundamental feelings and emotions. It is a period of body building, egoism, and self-preparation. The chief motive is physical hunger, including the instinct of self-preservation.

From the early twenties to forty-five or fifty the whole purpose and nature of life changes. It is now actuated by sex hunger, procreation, parenthood, and the protection and care of the young. As the former life centered in the immediate interest of the individual, the development of a strong body and an energetic mind, the present life centers around the needs and immediate interests of offspring. It is to a degree social and altruistic. We begin to live for others: the family, the clan, the tribe, the race, the nation. It is the period of construction, homemaking, industry, practical sciences, lower patriotism, sectionalism, nationalism. In a broad sense it is the volitional period of life *par excellence,* when men for the sake of offspring and his immediate group executes the earlier fundamental functions of the world's work.

From fifty to seventy-five or eighty, as life is now constituted, is another vitally important period to every normal individual. It is the period of intelligence *par excellence* when the individual, who has lived in harmony with nature's plan, is free and ready to render his best service to humanity. The individual who has lived wisely, and passed normally through the other two stages, is now ready to enter efficiently and religiously upon his highest life's work. It is to the healthy individual, the period of constructive thinking, as the first was one of feeling and emotion, and the second, one of volition. The fundamental motive now is the hunger for truth, the desire to know the true purpose of life, and the will to render the greatest service to mankind. Man has now come into vital touch with his spiritual inheritance, the last great level on and through which he is permitted to live; but how worthy may be the ending and the service rendered.

Each level, no doubt, represents ages of static conditions of the race, until some fortuitous variation, more useful than others, led the race that survived to a higher level. Through these ages of struggle and push upward of our ancestors, we may move rapidly through the entire history and come again into vital touch with the essential experiences of the entire past. The latter is what is meant by true culture. To all individuals such a mission is possible and intended. If we do not live to enter upon it, or become fixed in a lower level when it was intended we should serve in a higher, the fault is ours, our parents, or our teachers, and not that of nature.

I have turned over rapidly in your presence a few pages of the book of nature, quoting at random a few of the thoughts that appeared on the surface; that I have not been able to select the best nor completely satisfy my hearers is as plain to me as it is to you. With this foundation I should like to discuss more fully the mental development of children. If

you have followed me thus far, you can add the details; if you have not been able to follow me, the details themselves would be uninteresting. True intelligence can only be developed when the organism concerned is nascent and supplied with sufficient energy. Some minds are able to utilize more intellectual food than others, and there are times when all are dull. All children respond to teaching that is well directed and furnished in proper quantity and right quality. The three intellectual periods mentioned above are the ones in which the growth of intelligence should be stressed, but all levels are vital to the life of the individual and should be given sufficient food and stimulation when nascent. The three psychic elements of feeling, willing, knowing are combined in every act and so interrelated that one cannot be developed far without the other.

One fact of human development I should like to leave with you with such burning clearness that you can never forget it. The book of nature from which I have been sketching is written, through nervous complexes, impulses, traits, instincts, indellibly in the soul of every individual. The least stimulation of these latent elements when nascent and ripe will set them off. When nature becomes to you a mirror, look in; behold thyself and see God. Why any man who by controlling his own complexes and working out his own salvation might become great, should desire to force his thought and methods of thinking upon another, thus preventing the other from reaching his highest goal, is an enigma hard to understand. Teachers should avoid it and never give for truth what is not truth. Education should make men free, and not slaves.

Are you intelligent and clean? Are you blessed with a real hunger for truth? Have you been a faithful student of child-life? Do you *really love children? All children?* You are saved; go forth and save others.

STANFORD-BINET TESTS OF 112 KINDERGARTEN CHILDREN AND 77 REPEATED TESTS

IRENE CUNEO AND LEWIS M. TERMAN

PURPOSES

The purposes of this study were as follows: (1) To find the distribution of intelligence among kindergarten children: (2) to correlate the results of Stanford-Binet tests with school marks and teachers' estimates of intelligence; (3) to determine the effect of the repetition of a test upon the resulting intelligent quotient; and (4) to secure data which would throw light on the proper location of the tests in the scale.

SUBJECTS

Tests were made of 112 children, 77 of whom were tested twice. Of the 112, 49 were attending the kindergarten of the San Jose State Normal School and included the total attendance of that department. The remaining 63 were chosen at random from kindergartens in San Mateo, Cal.

As far as could be ascertained, our group of subjects may be considered fairly representative as regards social status. The large majority came from middle-class homes, a few from each extreme.

All of the 112 children were American born and the parents of all but six were of North-, Central-, or West-European descent and had been long in America. Of these six, four were Italian and two Portuguese.

The sex and age selection was accidental and resulted in the testing of 65 boys and 47 girls of the following ages:

Age	Boys	Girls	Total
3-7 to 4-0	5	4	9
4-1 to 4-6	9	7	16
4-7 to 5-0	11	9	20
5-1 to 5-6	13	13	26
5-7 to 6-0	20	11	31
6-1 to 6-6	6	2	8
6-7 to 7-0	1	1	2
Total	65	47	112

CONDITIONS

All the tests were made in a small side room, under conditions which were for the most part quite satisfactory. There

were few distractions or interruptions and the children were interested in the tests. A test usually required from 30 to 40 minutes, but there was little evidence of fatigue. In all but two or three cases suitable rapport was quickly established.

In giving the tests, the directions set forth in Terman's *The Measurement of Intelligence* were adhered to strictly. The responses were recorded verbatim. The tests were all of wide enough range to include one year in which there was no failure and one year in which there was no success.[1]

The Distribution of Intelligence Quotients

The intelligence quotients found are given in Table I. This table includes only intelligence quotients resulting from first tests, those resulting from repeated tests being here ignored.

Table I. Intelligence Quotients Found

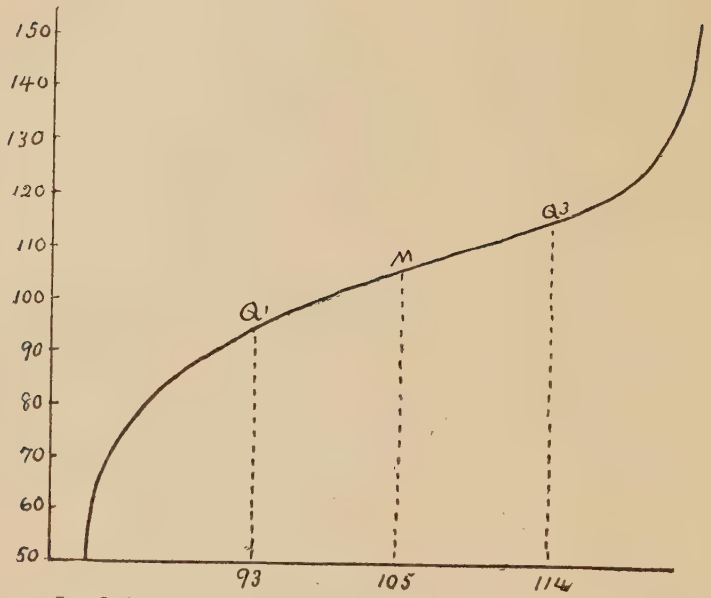
61	86	96	102	109	113	121
72	86	96	102	109	114	121
75	88	96	102	109	114	122
76	90	97	103	109	114	123
77	90	97	103	109	114	124
79	90	98	103	110	114	124
80	90	98	105	110	114	125
80	91	98	106	110	117	126
80	91	99	106	110	117	126
80	92	100	106	111	118	129
81	93	100	107	111	119	130
82	93	100	107	112	119	130
84	93	101	107	112	120	136
85	94	101	107	113	121	142
85	94	102	108	113	121	146
85	96	102	108	113	121	152

Graph I shows the distribution of intelligence quotients plotted in the form of an ogive. Graph II shows the surface of distribution resulting when the intelligence quotients are grouped in ranges of ten: 60-69, 70-79, 80-89, etc.

The intelligence quotients range from 61 to 152. The median is 105, the lower quartile 93, the upper quartile 114. The semi-interquartile range is 10½.[2] The distribution closely approximates the normal, but the high median indicates either that the Stanford Revision is still somewhat too easy in the lower range or that the children tested are on the whole somewhat superior.

[1] The tests were all made by Miss Cuneo. Her preparation for the work included a theoretical course in mental measurement, one year of work in experimental psychology, and graduation from a kindergarten training course. The scoring was all checked over by me and the results were worked over and written up by us jointly.—Lewis M. Terman.

[2] These values are obtained from the smoothed curve.



GRAPH I. Ogive for Table I, showing distributions of intelligence quotients

GRAPH II. Distribution of intelligence quotients of 112 kindergarten children, sexes taken together

In order to test the former hypothesis the children were divided into two age-groups, the first including those between 3 years 8 months and 4 years 11 months, the latter those between 5 years 0 months and 6 years 11 months. The median intelligence quotient for the younger group was 107.5, that for the older group 102.5. If we could be sure that selection had entered equally into the two groups this would indicate that for children of 4½ years the scale still yields a mental age which is approximately 7% (or 4 months) too high, but that this error largely disappears as we approach the mental age of 6 years. It is possible, however, that in a given kindergarten class the younger children are on the average somewhat better endowed than the older. At least this has been quite generally found to hold true in other school grades, and we can therefore not be certain to what extent the high median I Q is due to the selection of subjects and to what extent it

TABLE II. SHOWING MENTAL AGES FOUND IN THE DIFFERENT CLASSES

A	B	C	D	E
3–10	4–1	3–4	3–4	3–4
4–1	4–1	4–2	4–0	3–10
4–3	4–3	4–6	4–2	4–6
4–3	4–4	4–6	4–2	4–10
4–7	4–7	4–8	4–6	5–0
4–7	4–8	4–8	4–6	5–2
4–8	4–9	4–10	4–8	5–2
4–9	5–5	4–10	4–8	5–8
4–9	5–6	5–0	4–10	5–10
4–11	5–9	5–2	4–10	5–10
4–11	5–10	5–2	5–2	6–0
5–0	5–2	5–4	5–3	6–2
5–1	6–3	5–4	5–8	6–4
5–3	6–6	5–6	6–0	6–6
5–3	6–6	5–6	6–2	6–8
5–4		5–7	6–3	6–8
5–6		5–9	6–6	6–10
5–8		5–10	6–6	7–3
5–8		6–0		
5–10		6–3		
5–11		6–4		
6–0		6–6		
6–0		6–6		
6–0		6–6		
6–0		6–9		
6–1		6–10		
6–2				
6–2				
6–4				
6–4				
6–6				
6–9				
6–10				
7–5				
7–7				

is due to imperfect standardization of the tests. In all probability both factors enter. Certainly the results do not warrant any extensive revision of the lower part of scale as it now stands. For practical purposes it is better for the scale to err, if at all, by being slightly too liberal.

It will be noted that only one subject tested below 70. This child (I Q 61) was recognized by the teacher as hopelessly feeble-minded. On the other hand, 6 tested as high as 130, 3 as high as 140, and one above 150.

Distribution of Mental Ages

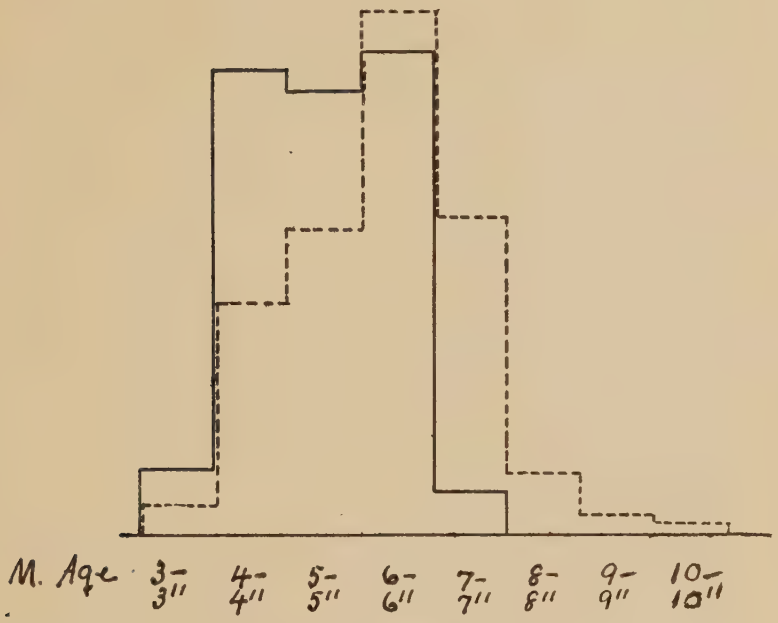
As already stated, the children of five classrooms were tested. The mental ages found are shown for the five classes separately in Table II.

The range in each class is found to be astonishingly great. In class A it is from 3-10 to 7-7; in B, from 4-1 to 6-6; in C, from 3-4 to 6-10; in D, from 3-4 to 6-6; and in E, from 3-4 to 7-3. Where there is so little homogeneity the task of fitting the work to the individual ability of the children must be very difficult if not impossible. To give the same school tasks to children ranging from 3 years to 7 years in intelligence cannot be justified on any grounds, and the practice of some kindergarten teachers in dividing the class into groups according to mental maturity is strongly to be commended.

Table III. Showing Per Cent of Kindergarten Children and First Grade Children at Each Mental Age

Mental Age		3 to 3–11	4 to 4–11	5 to 5–11	6 to 6–11	7 to 7–11	8 to 8–11	9 to 9–11	10 to 10–11
Per cent	Kindergarten	4.5	31.2	29.6	32.2	2.7			
	First grade	2.	15.4	20.4	35.	21.3	4	1.3	.67

Comparison of the mental ages of these 112 kindergarten children with the mental ages of 150 unselected first-grade children tested by Mr. Dickson may be made from Table III and Graph III. In fact, 17% of the kindergarten children equalled or exceeded the median mental age of those in the first grade, 66% equalled or exceeded the lower quartile for the first grade, and three equalled or exceeded the first-grade upper quartile. At least one-fourth of the kindergarten children have a mental maturity which would enable them to do satisfactory work in the first grade, while of Mr. Dickson's 149 who are in the first grade considerably more than one-third ought to be in the kindergarten.



GRAPH III. Showing how kindergarten children and first grade children overlap in mental age
Unbroken line = kindergarten children
Dotted line = first grade children

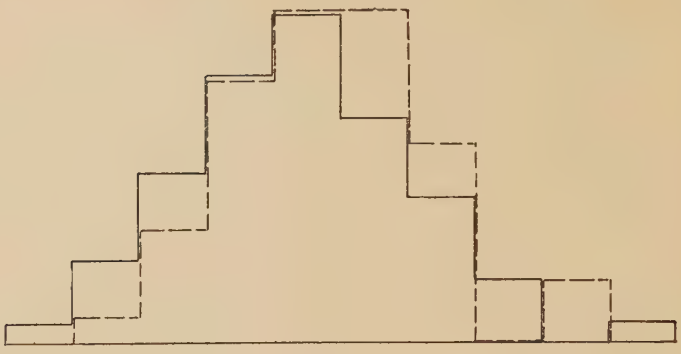
SEX DIFFERENCES

Comparison of the sexes showed that the girls have a higher median intelligence quotient but less variability than the boys. The facts are summarized in Table III and Graph IV.

TABLE IV. COMPARISON OF SEXES

	Median I. Q.	Lower quartile	Upper quartile	Q.
Boys	103	90	114	12
Girls	108	96.5	116.5	10

Although the brightest subject tested was a boy, it is seen that the girls have a significantly higher intelligence quotient. A part of this superiority may be accounted for by the fact that the median age of the girls is three months less than that of the boys. Sixty-four per cent of the girls were below the age of 5½ years, but only 47.7% of the boys. If, as seems probable, the scale grades somewhat more leniently at five years than at six, this would give a slight advantage to the girls in our comparison. When both boys and girls were



	60-69	70-79	80-89	90-99	100-109	110-119	120-129	130-139	140-149	150-159
Boys, %	1.5	6.2	13.8	20	24.6	16.9	10.8	4.6	0	1.5
Girls, %	0	2.1	8.5	19.5	25.5	25.5	14.9	0	4.3	0

Graph IV. Distribution of intelligence quotients of 65 boys and 47 girls in kindergarten classes.
Boys, unbroken line
Girls, dotted line

divided into two age groups, those below and those above five years, it was found that the median intelligence quotient for the younger group was higher for both sexes. For the boys, the median of the younger group was 104; that of the older group 102. For girls, the median of the younger group was 110; that of the older group 106. The girls are superior in each group, but the fact that there is a larger proportion of the total number of girls in the younger group than is the case for boys would give a slight advantage to the girls in the comparison of both age groups taken together. It is unlikely, however, that this alone would account for the difference between 103 (median for boys) and 108 (median for girls).

It is probable that, age for age, girls are slightly superior to boys in the kind of intellectual ability measured by the usual type of intelligence test. This conclusion is borne out by the results of many other investigations by the test method. It is also in harmony with sex comparisons based on teachers' ratings and school marks. In the present study, 56 of the boys and all the girls were rated for intelligence and 46 of the boys and 36 of the girls for quality of school work. The results are shown in Table V.

In something like a dozen separate studies we have found that for a given age or grade, girls invariably make a better

TABLE V. SEX DIFFERENCES IN INTELLIGENCE RATINGS AND SCHOOL WORK

	Very inferior	Inferior	Average	Superior	Very superior
Intelligence: Boys	1	9	35	8	3
Girls	0	3	29	10	5
School work: Boys	1	10	27	6	2
Girls	0	3	21	11	1

For teachers' ratings, therefore, we have:

	Inferior and very inferior	Average	Superior and very superior
Boys	17.9%	62.5%	19.8%
Girls	6.4%	61.7%	31.9%

For quality of school work:

	Inferior and very inferior	Average	Superior and very superior
Boys	23.9%	58.7%	17.4%
Girls	8.3%	58.3%	33.3%

showing than boys when rated by their teachers either for intelligence or quality of school work.

Comparison of the intelligence quotients of our boys and girls for variability shows that the girls are decidedly less variable. The boys range from 61 to 152, with a semi-interquartile range of 12. The girls range from 75 to 146, with a semi-interquartile range of 10. Application of Pearson's formula for determining the coefficient of variability $\left(C=\frac{Q}{M}\right)$ shows the girls 20.5% less variable than the boys. This supports the usual view as against that of Karl Pearson and Dr. L. S. Hollingsworth. It does not agree with our data on 1,000 unselected children, but is in harmony with two other Stanford University studies.

The sex differences found in the individual tests are given elsewhere in this paper. In general, such differences were not large.

CORRELATIONS OF TEST RESULTS WITH TEACHERS' RATINGS AND WITH SCHOOL MARKS

As already stated, 103 of our 112 children were rated by their teachers for intelligence.[3] We did not give the teachers any definition or criterion of intelligence, but simply asked them to classify the children on the basis of intelligence into

[3] The names of 9 boys were omitted from the list by oversight.

five groups: "very inferior," "inferior," "average," "superior," and "very superior." The results of this classification were shown in the preceding section.

The correlation of intelligence quotients with the teachers' estimates of intelligence (Pearson method) proved to be only .29 ± .06. This correlation is much lower than we are accustomed to find in the case of children attending classes above the kindergarten. Such correlations usually fall between .50 and .75. The low correlation found for kindergarten children may be partly accounted for by the nature of the kindergarten curriculum. The work is very general and for the most part very easy. Nothing is taught which offers the teacher a solid basis for estimating the pupil's intelligence.

Certain disagreements between ratings and intelligence quotients were plainly due to constant errors on the part of the teachers. There was frequent failure to take account of age differences. The 6-year-old is rated "superior" on an intelligence quotient about 10 to 20 points lower than a 4½-year-old must have to reach this class. The former gets in as easily with 100 I Q as the latter with 115 or 120.

The following cases illustrate this error: G. J., age 3-8, mental age 4-2, I Q 113, was rated as "inferior;" while M. L., also testing at 113, but aged 5-9, was rated "superior."

N. W., age 3-11, mental age 4-3, I Q 108, is rated "inferior;" J. M., age 6-11, mental age 6-6, I Q 94, is rated "superior."

M. S., age 4-1, mental age 5-4, I Q 130, is rated "inferior;" J. P., age 6-3, mental age 6-10, I Q 109, is rated "very superior."

This tendency to ignore age differences seems almost universal among teachers. There is probably no other cause of so much misunderstanding of pupils. Even when specifically told to take age into account teachers fail to do so to anything like an adequate extent. They have not grasped the significance of age norms.

The correlation between ratings and intelligence quotients was also lowered by the tendency of teachers to grade too many pupils "average."

It was possible to have 35 of the children rated by two teachers. The correlation found was .49 ± .085.

Intelligence Quotients and School Work

The pupils in four classes, 82 in all, were rated for quality of school work as well as for intelligence. The same classification was used, very inferior, inferior, average, superior, and very superior. The correlation of school success (based on this classification) and intelligence quotient was .267 ± .07.

The factors which entered to produce a lower correlation between intelligence quotients and teachers' ratings are also operative here. Teachers base their estimate of a pupil's intelligence chiefly on ability to do the school tasks, disregarding age.

Mental Age and School Work

The correlation between mental age and school work is shown in Table VI. The correlation ($r = .43 \pm .05$) is moderately high, but lower than we have ordinarily found for children in the grades above the kindergarten. The corresponding figure for Dickson's first grade children was .725.

From Table VI it will be seen that not a single pupil of the 21 who tested below 4-9 in mental age was graded above "average" in school work, and that only one of the 33 testing above 5-9 was graded below "average."

Table VI. Showing Correlation Between Mental Age and Quality of School Work

Mental age	Very Inferior	Inferior	Average	Superior	Very Superior
7–4 to 7–10			1		
6–10 to 7–3			1	1	1
6–4 to 6–9			9	3	
5–10 to 6–3		1	9	5	1
5–4 to 5–9		2	3	3	
4–10 to 5–3		2	13	4	
4–4 to 4–9		3	5		
3–10 to 4–3	1	4	5		
3–4 to 3–9		1	2		

$r = .43$

Repetition of Tests

In order to secure data on the reliability of the intelligence scale for diagnostic purposes, 77 children were retested in three groups:

Group A, 25 pupils, interval of 2 days between tests.
Group B, 21 pupils, interval of 5-7 months between tests.
Group C, 31 pupils, interval of 20-24 months between tests.

The correlations were computed by the Spearman's footrule and the R values were changed to r values by a conversion table. The results were as follows:

Group	Interval	r correlation	P. E.
A	2 days	.95	.013
B	5-7 months	.942	.014
C	20-24 months	.852	.034

TABLE VII. SHOWING RESULTS OF 77 REPEATED TESTS

Group A, 2 days			Group B, 5–7 mos.			Group C, 2–24 mos.		
Age (Real) 1st Test	I. Q. Test 1	I. Q. Test 2	Age Test 1	I. Q. Test 1	I. Q. Test 2	Age Test 1	I. Q. Test 1	I. Q. Test 2
4–4	146	144	4–1	130	130	4–6	152	141
3–10	126	135	6–6	126	125	4–6	142	129
4–9	126	133	5–10	124	127	5–6	136	128
4–11	122	119	5–3	124	122	3–11	130	124
5–3	117	123	5–6	118	110	4–6	129	119
5–8	114	105	5–10	114	108	4–0	123	119
3–8	113	109	5–11	112	105	4–11	121	126
5–8	112	114	5–10	111	118	4–11	121	117
4–3	110	118	5–1	110	116	5–1	121	116
5–0	103	107	5–8	109	120	6–4	121	108
5–1	102	105	6–3	109	105	5–2	120	107
4–6	100	112	4–10	107	111	5–8	119	115
5–7	98	101	4–11	105	115	5–1	117	130
4–11	98	98	5–5	101	108	4–9	114	109
5–4	98	92	5–11	97	101	5–5	111	114
4–10	96	96	5–11	96	83	4–4	110	116
5–11	96	103	3–8	91	84	5–1	108	112
4–3	94	90	5–2	90	84	5–11	107	113
4–6	93	93	6–2	86	89	5–8	106	99
4–10	93	93	5–10	86	88	5–9	103	102
4–7	91	94	5–6	61	54	4–0	102	100
5–11	82	84				4–11	93	98
5–8	80	80				4–6	90	108
8–1	77	79				6–4	90	106
4–6	76	85				5–3	90	96
						5–6	85	100
						5–1	85	80
						4–10	80	108
						6–0	79	87
						5–2	75	98
						5–8	72	101

The correlations for Group A and Group B are seen to be very high, and for Group C somewhat lower. This is what we should expect, considering the greater interval by which the tests of Group C were separated. In Group A there was no change greater than 12 points, and only two above 9 points. In Group B there was no change greater than 13 points, and only three above 8 points. Group C gave three rather wide discrepancies, one of 23, one of 28, and one of 29 points. The last two of these three cases should probably be thrown out, as the mental age recorded for the inital test was based on the child's refusal to respond to most of the tests above the four year group. This was interpreted at the time as inability to respond. In all probability it was due to shyness,

a disturbing factor which is sometimes difficult to overcome in testing children of kindergarten age.[4]

In general the agreement between the first and second tests is close enough to show that whatever abilities the scale tests are measured with a high degree of reliability. This is best seen in the low median amount of change. The median change and the lower and upper quartiles of the changes were as follows:

Group	Median change	Lower quartile of changes	Upper quartile of changes
A	3	2	7
B	6—	3	7
C	6+	5	13
A, B, C, together	6	3	8

When we consider the *direction* of the changes we find that the gains and losses are pretty evenly divided in each of the three groups.

	Retests showing gains	Retests showing loss	Central tendency of change
A	14	6	+2
B	9	11	—1
C	15	16	0

It appears, therefore, that in the case of young children memory of a previous test has no appreciable influence after the lapse of a few months, and that the effect is negligible even after an interval of only two days. This fact is important for the practical usefulness of the scale.

Do bright or dull children gain more in the repetition of a test? In each of the three groups, A, B, C, we have compared those above 100 I Q (first test) with those below 100, in regard to the amount of gain or loss.

In Group A, there are 12 children who earned an I Q of 100 or more in the initial test. Eight of these gained in the second test and four lost. Of the thirteen who tested below 100, six gained, two lost, and five neither gained nor lost. The central tendency for those above 100 represents a total average gain of 2.75 points; the central tendency for those below 100 is toward an average gain of 1.2 points.

In Group B, seven of the twelve children above 100 I Q. show a gain, six a loss, and one no change. Of the seven below 100, three show a gain and four a loss. The central tendency for those above 100 was toward an average gain of 1.4; for those below 100, an average loss of 2.

[4] The initial tests given to Group C were Miss Cuneo's first experience in the use of the Binet scale. This may explain in part the lower correlation for Group C.

TABLE VIII. SHOWING PER CENT PASSING AT DIFFERENT AGES

	AGE			
III	4	5	6	7
Points, etc.	100	100	100	100
Key, etc.	100	100	97	100
Pictures	94	100	100	100
Sex	100	100	100	100
Name	94	94	97	100
6–7 syllables	94	100	100	100
3 digits	100	100	100	100
IV.				
Lines	72	94	100	100
Forms	Omitted			
4 pennies	67	83	89	100
Square	39	81	92	96
Comprehension	78	92	94	100
4 digits	94	94	92	100
12–13 syllables	78	88	92	100
V.				
Weights	17	52	73	100
Colors	33	65	73	96
Prettier	61	71	77	96
Definitions	61	75	80	100
Patience	17	60	73	87
Commands	50	73	80	96
Age	28	44	66	96
VI.				
Right-left	33	46	73	87
Omissions	28	35	61	87
13 pennies	11	44	59	100
Comprehension	44	62	81	96
4 coins	11	38	62	87
16–18 syllables	11	40	56	91
A. M., P. M.	28	44	50	78
VII.				
Fingers	0	8	31	70
Pictures	17	29	64	83
5 digits	17	46	64	91
Bow knot	6	4	28	65
Differences	0	17	34	57
Diamond	0	8	30	78
Days	Usually omitted			
3 digits bkd	Usually omitted			
VIII.				
Ball-field	11	6	36	57
20–0		2	14	39
Comprehension	11	15	30	70
Similarities	0	10	31	48
Definitions	0	0	8	39
Vocabulary	0	0	5	9
Six coins	0	2	2	26
Dictation	Omitted			

In Group C the situation was reversed. Only five of the twenty above 100 I Q gained, while nine of the ten below

100 gained. Above 100, the central tendency was toward an average loss of 3.6 points; below 100, toward an average gain of 14.3. As already stated, we believe that the excessive gains made by a small number of children of Group C who fell low in the initial test was due to failure in the first test to overcome timidity. The scores of Groups A and B offer a better comparison because they were made after much more experience in testing kindergarten children, and the data for these two groups indicate that bright children profit but little more from memory of a recent test than do dull children.

Data on the Individual Tests

Table VIII gives the per cent passing each test at the ages 4, 5, 6 and 7. Age 4 includes the range 3-6 to 4-5, age 5 the range 4-6 to 5-5, etc. The 77 repeated tests are counted as though they were tests of so many children in addition to the 112. The effect is that of $112 + 77$, or 189 tests in all.

It will be seen from Table VIII that the several tests of any given year differ little in difficulty. In IV, the "comprehension" test is relatively easy for its group; in V, "patience" and "age" are relatively hard; in VI, "comprehension" is relatively easy; in VII, "bow knot," "differences" and "fingers" are relatively hard, while "pictures" and "five digits" are relatively easy; in VIII, vocabulary test is much too difficult.

Although the age-groups merge into one another in difficulty, the tests of no group seriously overlap those of an adjacent group.

Table IX shows the average per cent of passes, by age, for the tests of each group taken together.

Table IX. Average Per Cent of Passes for the Tests of Each Age Group Taken Together

	Average per cent passing at each age			
	4	5	6	7
Tests of III (combined).....	97%	99%	99.5%	100%
IV.....	71	88.6	93.1	99
V.....	38.1	63	74.5	95.7
VI.....	23.7	44.1	63.1	89.4
VII.....	6.6	18.6	41.8	74.
VIII.....	3.1	5.	18.	41.

Sex differences in per cent passing were not numerous or large. The comparison was made separately for the two ages 4-7 to 5-6 and 5-7 to 6-6. There were not enough subjects above and below these ages to justify further comparison. The significant differences found are presented in Table X.

TABLE X. TESTS SHOWING SEX DIFFERENCES

Test	Per cent passing				
	Age 4-7 to 5-6		Age 5-7 to 6-6		Advantage
	Boys	Girls	Boys	Girls	
Colors	59	72	64	88	Girls
Prettier	56	88	72	84	"
Patience	48	72	72	76	"
Right-left	33	60	74	72	"
Omissions	26	44	54	72	"
16-18 syllables	67	80	74	88	"
A. M., P. M.	56	32	56	40	Boys
5 digits	44	88	59	72	Girls
Bow knot	7	0	21	40	"

SUMMARY

1. The Stanford-Binet scale was given to 112 representative kindergarten children. Of these, 77 were tested twice.

2. The intelligence quotients ranged from 61 to 152, with the median at 105. The distribution closely approximated the normal. The difficultness of the Stanford Revision in this part of the scale was found to be not far from correct. If there is any error it is on the side of leniency.

3. The girls had a higher median intelligence quotient than the boys, but had a coefficient of variability 20 per cent less than that of the boys.

4. The mental ages ranged from less than 3½ to more than 7½ years. This gives rise to a serious problem in kindergarten instruction.

5. The correlations found between intelligence quotients and teachers' ratings, mental age and school marks, etc., were rather low. This was traced to certain constant errors to which teachers are subject and to the fact that the kindergarten work offers little basis for the estimation of intelligence.

6. Repeated tests gave a correlation of .94 after a half-year interval, and a correlation of .85 after a two-year interval.

7. Tests repeated within 48 hours showed little effect of practice. In repeated tests the bright profit slightly more than the dull.

8. The per cents passing each test at each age do not appear to warrant any radical changes in location or scoring of tests.

9. But few of the tests showed significant sex differences in per cents passing.

TEACHING CIVICS AS A SCIENCE IN THE JOLIET TOWNSHIP HIGH SCHOOL

By R. R. Smith

In the first place the reader must believe that civics is a science. If he is in the least doubt concerning the matter, he should consult an unabridged edition of Webster at once. He will find the subject classified as a science. He will furthermore find that science is knowledge duly organized and systematized. This definition certainly applies to civics which is supposed to place before the student an organized and systematized knowledge of government, a knowledge which has been gained from a study of history.

Now we come to this interesting syllogism which the reader is cordially invited to tear into fragments if he can; (1) science should be taught by the laboratory method; (2) civics is a science; (3) civics should be taught by the laboratory method.

There is not likely a teacher so antiquated that he will deny the truth of the major premise, although it took humanity almost 1900 years to stumble upon its truth by the inductive method of accidental observation, an expensive scientific method which has been too much in vogue for humanity's good. There is not likely a teacher who will deny the verity of Webster, or who will deny that the definition of science is applicable to civics; so our minor premise is safe.

The conclusion must follow. We have no choice in the matter.

Naturally, with such a syllogism in my mind, I have always believed in pupil self-government from the purely scientific basis which means that I have believed in it as a disciplinary measure as well.

When I came to Joliet Township High School four years ago I came not only with that syllogism in my mind, but with a number of successful experiments in smaller schools to my credit.

On analysis of the larger school conditions two things were apparent: (1) the school needed the stimulus which can come only when the governed have a share in the government; (2) the only difficulty in the way of organizing the larger school was getting a working unit.

However, popular government comes as a result of growth on the part of the body politic toward a desire for such a government. Believing that, I went to work systematically to build up a sentiment in favor of student government among the students themselves.

I talked student government among the students; I taught student government in my classes. I organized a club which died. I organized the senior class in order to bring the pressure of the majority of the class upon a minority who insisted upon using the high school column in the local paper for personalities of a very inane and deplorable sort—an organization which came near losing my job for me. Since this is a history of facts I owe it to the two boys in question to state that since then they have become very reputable newspaper men and are, as I have reason to think, my friends. I organized an English class into a club a report of which has already appeared. [See Bulletin of Illinois Association of Teachers of English of the Kewpy Club, Sept., 1917.]

The propaganda worked as propaganda will. The present senior class was not greatly affected. They are still inclined to scoff at the idea of self-government and to take it as their right to be knocked down—a state of mind which means that they rebel at being confronted by real problems to solve. But the present junior class would organize their room in a minute if allowed to, and one group, the 8th period one, is in a fair way of being allowed to. The sophomore class are ready for self-government as are the freshmen.

It is with a group of these sophomores that the paper has to deal. However, I must explain that shortly after coming here, I was given charge of one of the large home rooms which is used also for a study room. This is largely a sophomore room and here the sophomores study each of their twelve periods during the day.

At the close of last semester I asked that I be given permission to organize each of the twelve study periods for student government, but I was not permitted to do so. However, I was given charge of the twelfth period myself.

As I was doing an immense amount of war work outside of my regular school activities, and was manager of athletics in addition, I needed the period for myself. Consequently I immediately placed the proposition of government before the students. They responded in the affirmative.

I would like to state at this point that for success in a large school the machinery of the system must be simple. There is not time for the old New England town meeting type of procedure, as there is in a small school.

Our procedure was simplicity itself. Acting on the affirmative answer given, I drew up the following pledge which each

student signed: "We the students seated in room 329 the 12th period, hereby pledge ourselves individually and through our officers to keep the room in order." Our next step was to elect four students to take charge of the room. Two students were to look after the discipline and two were to do the clerical work. The two sets were to be on duty on alternate weeks.

No new rules were made. Throughout the time I have been in charge I have preached "Think of the other fellow." I have insisted that students move quietly.

The principal rules in force in all study rooms are these: (1) pupils may leave the room only with duly signed pass blanks; (2) pupils who wish to speak must come to the desk for permission. These two rules reduce the confusion to a minimum.

The experiment has worked. The order has been as good as if a teacher were in the room. The morale has been much better. There have been no cases of discipline which the students in charge cannot handle.

Of the two students in charge, one is superior in every way. She is popular with the students. She is popular with the teachers—She makes high grades. The training in leadership has been of great value to her just as such training is always when it is real training.

The other student is bright enough. The fact that he is able to handle the room shows his ability. But he does not fit into the school machine so far. However, his grades have been no worse than last semester and his self-control is much better. An incident which happened not long ago is illustrative. Misunderstanding came up between him and a teacher. Because, through his self-government training, he had learned to check his emotions and make himself give his final decision as a result of reason, he was able to meet the teacher in question, talk over the situation, and come to an adjustment. Without such training he would have left the school in anger.

What the immediate future of pupil government here will be I do not know. But the American high school can do no greater service to the nation than to prepare its students to govern themselves sanely. Civics is a science hence should be taught by the laboratory method. In every high school in the United States there are from one to five big study halls that are by nature civics laboratories. To utilize these study halls as civics laboratories would not incur additional expense but would save many thousands of dollars in teachers' salaries. Is not failure to utilize this waste material an indictment against America's intelligence? Is it not really an invitation for the Kaiser to come and take up his government of the nation as an autocracy?

COMPARATIVE MENTALITY OF JEWS AND GENTILES

N. M. Grier, Academy of Science, St. Louis, Mo.

Military records show that as a people the Jews have long been noted for their deficient vital capacity. The burden of evidence as presented by Smedley, DeBusk, and as corroborated by Goddard have shown that mental ability in school children (school standing) may be positively correlated with vital capacity.

A common impression seems to prevail at times that, as a people, the Jews have a greater mental ability than their less enterprising Gentile brethren. The "smartest" pupil of the public school classes was usually of Jewish descent, and it is undeniably true that some of the most brilliant scientific men and scholars of the 19th and 20th centuries have had a similar heritage. One phase of this supposed mental superiority has been exploded by Fishberg in his book on the Jews which points out that the greatest percentage of successful business men is found among the Gentiles, but that a greater percentage of business men in proportion to number of people in the race is found among the Jews.

The writer has been able to obtain records of the vital capacity of 112 Jewish boys and 54 Jewish girls of the high school age. These records show the following when compared with equal numbers of students of Gentile origin. The superiority of the latter in vital capacity as already indicated is manifest. When grouped by ages, and the average scholarship computed from their standing in the high school, a noticeable superiority in school standing as shown by the curriculum test was found to be with the Gentiles. This was observed to come most strongly at the earlier ages, slowly decreasing upwards, but at the age of 16, Jewish boys were slightly superior, which may be explained by the fact that large numbers of them leave school before this age and the survivors are thus selected individuals.

On the other hand, it seems that Jewish girls are mentally superior in this respect to Gentile girls at most ages compared, although the latter show higher scholarship at the age of 14. Evidence here is less easily taken due to the fact that even larger numbers of Jewish girls than boys seem to leave school past the first half of the teens. The same general results, however, are obtained when larger numbers of the more abundant Gentiles are compared.

Data obtained from tests conducted after the range of information plan on the biological subjects of the high school, when grouped as indicated previously, show that for 85 boys and 44 girls, each of both types of peoples, the error of marking is highest in Jewish boys and lowest in Jewish girls when compared with Gentiles. As the error of marking may be fairly considered as some indication of discriminatory power, the results presented in the preceding paragraph receive some confirmation. In this case, they are more independent of the marking of teachers, as the student grades himself. Any such factor as racial prejudice thus seems to be eliminated.

The Jews with whom these tests were conducted were the first generation of immigrants, and in the opinion of many are best representative. Of recent years, the matter of conservation in education

has been receiving greater attention, and the tendency is to give instruction more fitted to the peculiar individual. Aside from the humorous aspects of the proposition, if the preceding observations be more fully substantiated, it seems that special attention could be justifiably given to students of Jewish extraction. The writer at times has also noted large percentages of defective hearing and vision among children of this particular social stratum. The evidence for mental superiority in Jewish girls may be said by some to indicate greater application on the part of the latter, but it is perhaps worthy of the remark, that, following the conservation principle as fully as possible, something should be done to encourage larger numbers of them to complete a secondary education.

The writer offers the above as tendencies observed, rather than conclusions taken. He is indebted to Miss L. Persow, a fellow worker, for aid in this connection.

BOOK NOTES

Manual of Physical Education for the Public Schools of the State of California. Part IV, Syllabus on Physical Training Activities with Methods of Management and Leadership. By CLARK W. HETHERINGTON. Sacramento, California State Printing Office, 1918. 191 p.

Clark W. Hetherington has the rare distinction among physical trainers of being an experienced educator, a man well trained in modern psychology, and at the same time an excellent athlete. His position as State Supervisor of Physical Education in California, too, is so novel and unique that all educators interested in these themes will look upon this instalment, not the first in the series but the first to be published of a larger scheme, with peculiar interest; nor will they be disappointed. It is impossible to give an adequate review of what is itself essentially a syllabus, but it seems, as far as it goes and considering the ground it covers, to be the best thing in its field.

Moral Education in School and Home. By J. O. ENGLEMAN. Boston, Benjamin H. Sanborn and Co., 1918. 314 p.

The author, a teacher of long experience, has not found in the literature upon the subject any attempt to analyze the possibilities for moral instruction and training in the every-day activities of the school. This he chiefly attempts to do in chapters entitled: The Educational Ideal, The Psychology of Moral Education, Moral Training Through the Example and Personality of the Teacher, through School Discipline, through Reading and Literature, History, Geography, Current Events, through Music, Art, Religion, through Manual Training, Physical Culture, Games and Athletics, through Vocational Direction, Thrift, Sex Instruction, Boy-Scouting, Motion Pictures, and through the Bible. The final chapter is on the Moral Lessons from the European War. Under this last topic he discusses the value of physical preparedness, tells us how social vice can be made unattractive, discusses the temperance movement, decorations for personal bravery, the promotion of unity, cooperation, sacrifice and service, and the new work of the schools. One of the best features of this new and interesting book is the references for further reading at the close of every chapter.

Psychic Tendencies of Today. By ALFRED W. MARTIN. New York, D. Appleton and Co., 1918. 161 p.

This volume discusses the various aspects of the new psychic movements in the light of evidence in hand, including Spiritualism, Psychic Research, Theosophy, Christian Science and New Thought. Part One deals with the modern interest in psychic phenomena, and Part Two with the effects of healing by mental treatment. This is all contrasted with hypnotism, the Emmanuel movement, and psychotherapy. Part Three is a study of Sir Oliver Lodge's "Raymond." All this leads the author to the conclusion that modern materialism, instead of denying immortality, shows the scientific warrant for a belief in it.

Hindu Achievements in Exact Science. By BENOY KUMAR SARKAR. New York, Longmans, Green and Co., 1918. 82 p.

The main object of this little book is to furnish some chronological links and logical affinities between the scientific investigations of the Hindus and those of the Greeks, Chinese, and Saracens. The author, therefore, takes up sixteen topics, including six under Mathematics, to which he adds Kinetics, Astronomy and Physics, Metallurgy and Chemistry, Medicine, Anatomy and Physiology, and Embryology. He thinks that Hindu scientific investigation is no more mixed with metaphysics and superstitions than was the case in Europe. Nor was it confined to any one province of India, or class, or race. It is, in a word, the story of a growth and development in critical inquiry, sceptical attitude, and rationalism. Superstition has not had a deeper or more extensive hold on the Oriental than on the Occidental intellect.

Child Behavior. By FLORENCE MATEER. Boston, Richard G. Badger, 1918. 239 p.

This is a work that is greatly needed and covers an important field. The writer began with years of experience in Vineland in applying Binet-Simon tests. She has also been employed in testing immigrants to this country and to Canada. She has broadened and extended her experience at Waverley, and is now a valuable assistant to Dr. Goddard in his new and interesting state position in Ohio. No one takes a broader view of mental tests, or has done more to connect them with the wider fields of psycho-analysis and psychotherapy than Dr. Mateer. This book should be widely read and studied.

Human Conduct. By CHARLES CLINTON PETERS. New York, The MacMillan Co., 1918. 430 p.

This is a textbook in general philosophy and applied psychology for students in high schools, academies, junior colleges, and for the general public. It is indeed a venture in a new field, and for psychologists it is significantly dedicated to Professor A. Duncan Yocum. Some of the more important chapters are entitled: How Our World Gets Enriched, How Misunderstandings Arise, How Our Senses Deceive Us, Apperception and Tact, Race Apperception, How We Solve Our Problems, Our Concepts and How We Make Them Clear, How We Learn the Cause of Things, The Pitfalls of Reasoning, Control of Conduct through Idea, The Factors in Personality, Effective Use of the Memory, Mental Imagery, Imagination and Its Culture, Attention, The Making and Breaking of Habits, Character and Will, The Strong Self, How Work May Be Saved from Drudgery, Loyalty, Choosing a Vocation, The Psychology of Periods of Discouragement, The Strong Man's Religion.

We cannot think this book adequately represents present-day psychology or would be very attractive to the young. There is a paucity of illustrations, which might easily have been very numerous and very stimulating. Secondly, there is almost nothing, save in the most incidental way, said of the feelings, emotions, and sentiments, which are the most dominant powers of the soul at the age this book addresses. Thirdly, there is practically nothing concerning the genetic aspects of psychology in animals, children, etc., and fourthly, it barely touches upon the very rich field of psychopathy, from which so much extremely interesting material can be drawn.

The author belongs to a school of thought one chief trait of which is to disregard these fields that bring psychology into such close rela-

tion to daily life. There are elements of behaviorism, too, which could have been used with excellent effect. The book should properly have been entitled "How a Certain Sect of Philosophic and Psychologic Thought Regard Certain Aspects of Human Conduct." The most glaring and fatal defect of the book, however, is that it barely mentions those domains of life in which the young people live, move, and have their being. The author seems to the writer of this review to have almost no conception of what adolescence is or means, to say nothing of what it needs. A work in this field might be not only more effective morally, but might also serve as a most stimulating and inviting introduction to further study in the human soul. This book has the disease so common in textbooks of affected finality, so that it would probably serve mainly to inoculate the mind of the high-school student against any further interest in the subject.

Healthful Schools. By May Ayres, Jesse F. Williams, and Thomas D. Wood. Boston, Houghton Mifflin Co., 1918. 284 p.

School hygiene comprises two fields, healthful physical environment and healthful school activities, each of course divided into numerous subsections. The authors claim that the question of school hygiene has never before been thought of as a whole by educators. We have chapters on School Site, Building, Room, Classroom Equipment, Lighting, Water, Toilet, Heating, Ventilation, Fire Protection, Cleanness, Medical Inspection, Physical Training, Recreation, Exceptional Children, and a final chapter on School Feeding. The work is done in textbook style, with questions and references at the end of every chapter.

Soul Crises. By James William Robinson. Boston, Richard G. Badger, 1918. 291 p.

This is a volume of sermons addressed to young men, which so proved themselves to those who heard them that the author is inclined to seek a larger audience.

Western Canada is a young man's country, but it is a place where the spiritual interests of the young are not neglected. The writer is especially impressed with the necessity of making homes and communities a worthy environment for the return of the soldiers from the war.

We are told that Christ can do great things, even for the morally upright. The possibilities of the average man are dwelt upon, the story of the man who came back is forcefully told. Interesting is the chapter on Christian Athletes. The chief crises, the author concludes, are moral, domestic, spiritual, and national. These twenty-one discourses cannot fail to be stimulating and profitable to young men.

Idealism of the French People. By Louise Seymour Houghton. Boston, Richard G. Badger, 1918. 80 p.

This book is handicapped by having no index of its eighteen chapters and no table of contents. We are given first a little historic sketch of France, which seems to show that in all her previous wars she has really been unusually idealistic. The same is true of her literature. Even her politics has been inspired by the same tendency. We are given comparisons between the French and other people in this respect, to the advantage of the former. A great many incidents are cited which illustrate the passionate devotion of the French people to ideals. The consummation of all this is seen in the worship of

young heroes who have fallen, like Peguy, in such philosophers as Bergson, and in the ideals already forming as to the conduct of the people after the war.

The Rural School and the Community. A study of the application and methods of the social survey. By HOWARD T. LEWIS. Boston, Richard G. Badger, 1918. 91 p.

The writer attempts to epitomize the vast body of discussion in recent years concerning the rural school, a topic hitherto too much neglected. To this volume he attempts to supply some sociological principles, and apparently has made good use not only of the excellent bibliography, which he prints, but of considerable practical experience. He discusses the function of a survey, the teacher's relation to it and to the curriculum, the problem of the adult, and the training of the teacher.

Meanings of Music. By FLORENCE TRAILL. Boston, Richard G. Badger, 1918. 92 p.

These papers are based on talks to a Baltimore Woman's Club, but are very well worthy of a larger clientele. The topics are: Music in a Psychological Light, The Harmony of Theme and Form in Works of the Great Masters, The Musical Affinities of Italian Verse, The Purposes of Music, Grillparzer and Purcell, The Resources of the Music-lover.

A study of organization and method of the course of study in agriculture in secondary schools. By THEODORE HILDRETH EATON. New York, Teachers College, 1917. 183 p.

This follows the usual rubrics of the very many Teachers College monographs. We are told how the data were collected, classification made, selection of schools, their description, aims, equipment, teachers, salaries, age of the pupils, subjects taught, methods, correlation, adjustment, etc.

The organization of instruction materials; with special relation to the elementary school curriculum. By J. W. HECKERT. New York, Teachers College, 1917. 107 p.

This monograph covers the following topics: the observation of experience, its value, organization generally considered and as a factor in child life, present practices in curriculum-making, and applications of the principles studied, with illustrations.

Surveys in mental deviation in prisons, public schools, and orphanages in California. Sacramento, State Board of Charities and Corrections, 1918. 87 p.

Report of a survey of the University of Nevada. Bureau of Education, Bulletin, 1917, no. 19. Washington, Government Printing Office, 1917. 184 p.

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Psychological Monographs—Princeton, N. J.: Psychological Review Company.
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Journal of Philosophy, Psychology and Scientific Methods—New York:
Sub-Station 84. Bi-weekly. 728 pages per volume. Founded 1904.
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Archives of Psychology—Substation 84, New York: Archives of Psychology.
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Monthly (10 numbers). Psychology and training of defectives.

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Quarterly. Edited by George H. Blakeslee and G. Stanley Hall.

Journal of Educational Psychology—Baltimore: Warwick & York.
Subscription $3. 600 pages annually. Founded 1910.
Monthly (10 numbers). Managing Editor, J. Carleton Bell.
(Educational Psychology Monographs. Edited by Guy M. Whipple.
Published separately at varying prices. Same publishers.)

Journal of Animal Behavior—Cambridge, Mass.: Emerson Hall.
Subscription $5. 450 pages annually. Founded 1911.
Bi-monthly. Robert M. Yerkes, Managing Editor.

The Behavior Monographs—Cambridge, Mass.: Emerson Hall.
Subscription $5. 450 pages per volume. Edited by John B. Watson.
Published without fixed dates, each number a single research.

Psychoanalytic Review—Washington, D. C.: 3617 Tenth St., N. W.
Subscription $5. 500 pages annually. Psychoanalysis.
Quarterly. Founded 1913. Ed. by W. A. White and S. E. Jelliffe.

Journal of Experimental Psychology—Princeton, N. J.: Psychological Review Company. 480 pages annually. Experimental. Founded 1916.
Subscription $3.25 Bi-monthly. Edited by John B. Watson.

Journal of Applied Psychology—Worcester, Mass.: Florence Chandler.
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Edited by G. Stanley Hall, John Wallace Baird and L. R. Geissler.

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